Agile Product Lifecycle Management

SDK Developer Guide - Developing PLM Extensions

v9.3.2

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Preface

Oracle's Agile PLM documentation set includes Adobe® Acrobat PDF files. The Oracle Technology Network (OTN) Web site http://www.oracle.com/technetwork/documentation/agile-085940.html contains the latest versions of the Agile PLM PDF files. You can view or download these manuals from the Web site, or you can ask your Agile administrator if there is an Agile PLM Documentation folder available on your network from which you can access the Agile PLM documentation (PDF) files.

Note   To read the PDF files, you must use the free Adobe Acrobat Reader version 9.0 or later. This program can be downloaded from the Adobe Web site http://www.adobe.com.

The Oracle Technology Network (OTN) Web site http://www.oracle.com/technetwork/documentation/agile-085940.html can be accessed through **Help > Manuals** in both Agile Web Client and Agile Java Client. If you need additional assistance or information, please contact My Oracle Support (https://support.oracle.com) for assistance.

Note   Before calling Oracle Support about a problem with an Agile PLM manual, please have the full part number, which is located on the title page.

TTY Access to Oracle Support Services

Oracle provides dedicated Text Telephone (TTY) access to Oracle Support Services within the United States of America 24 hours a day, 7 days a week. For TTY support, call 800.446.2398. Outside the United States, call +1.407.458.2479.

Readme

Any last-minute information about Agile PLM can be found in the Readme file on the Oracle Technology Network (OTN) Web site http://www.oracle.com/technetwork/documentation/agile-085940.html.

Agile Training Aids

Go to the Oracle University Web page http://www.oracle.com/education/chooser/selectcountry_new.html for more information on Agile Training offerings.

Accessibility of Code Examples in Documentation

Screen readers may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, some screen readers may not always read a line of text that consists solely of a bracket or brace.

This documentation may contain links to Web sites of other companies or organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these Web sites.

New in Release 9.3.2

Because Oracle Application Server (OAS) is replaced with WebLogic Server (WLS), all references to OAS and Oracle Application Server are removed in this document.

New in Release 9.3.2

Changes in this release are summarized below:

- **Java Requirements** – A note describing the limitations to directly connect SDK code running under JRE 7 to proxy URLs that are protected by SSO and the workarounds was added in this release. See Java Requirements on page 4.

- **SDK Samples Folder** – The SDK_samples.zip file is moved to http://www.oracle.com/technetwork/indexes/samplecode/agileplm-sample-520945.html.

  Note   Oracle recommends using the Internet Explorer to access these sites.

- **Cookie Expiration Feature**– This feature is implemented to protect the PLM System from harmful intrusion by unauthorized users. See Setting Cookie Expiration Properties for URL Process Extensions on page 21

- **Other changes** – They include URL updates and format modifications.

Note   The PG&C constants and the relationships table functionality in `AgileAPI.jar` Release 9.2.2 and subsequent releases of Agile PLM are not compatible with those in the earlier versions of `AgileAPI.jar`.

Introduction

This chapter includes the following:

About this Guide - Developing PLM Extensions

Oracle's Agile Software Development Kit (SDK) is a collection of Java application programming interfaces (APIs), sample applications, and documentation that enable building custom applications to access, or extend the functionalities of the Agile Application Server. Using the SDK, you can create programs that extend the functionality of the Agile product lifecycle management system (PLM) and can perform tasks against the PLM system.

The SDK enables the following operations:

- Integrate the Agile PLM system with enterprise resource planning (ERP) applications or other custom applications
- Develop applications to process product data
- Perform batch operations against the Agile Application Server
- Extend the functionality of the Agile PLM system

The SDK Developer Guide is published in the following two books.

- **SDK Developer Guide – Using Agile APIs –** This component of the SDK Developer Guide provides information to develop batch operations against the PLM Server, integrate the PLM with other application, and process PLM data. This information is described and documented in *SDK Developer Guide - Using Agile APIs.*

- **SDK Developer Guide – Developing Extensions** – This component of the SDK Developer Guide provides background and procedural information to create additional PLM clients (extend Agile PLM functionalities) and work with PLM Frameworks. This information is described and documented in this book.

PLM Extensions

This component of the SDK Developer Guide documents the following extension frameworks that are developed in conjunction with the Java APIs, and tools such as Java or Groovy scripts:

▫ **Process extensions (Custom PXs)** – This framework enables Agile PLM customers to extend the functionality of Agile PLM. The functionality can be server-side extensions, such as custom workflow actions and custom autonumbering, or extensions to client-side functionalities, such as external reports, or new commands added to the Actions menu or the Tools menu. These PXs are implemented using the Java programming language.

▫ **Event Framework** – This framework supports Java process extensions (Java PXs), and Script process extensions (Script PXs). Similar to Custom PXs, they make it easier for PLM customers to extend the functionality of PLM clients to manage events by extending the function of an action taken by a user, an interface, or the system when the Event is triggered. Java PXs are implemented using Java and Script PXs are implemented using a scripting language called Groovy. Groovy is an object-oriented programming language for the Java Platform as an alternative to the Java programming language.

▫ **Web service extensions (WSX)** – This is a framework that allows Agile PLM customers to extend the functionality of the PLM system and expose the customer-specific solutions as a Web service.

▫ **Dashboard Management extensions (DX)** – DXs extend the functionality of the Agile PLM system. They provide the data, Dashboard Tabs, and the required formats to display the data (tables, charts, and URLs) that are configured in Agile Java Client and in Agile Web Client for authorized users.

SDK Components

The Agile SDK has the following Client-side and Sever-side components:

Client-Side Components

The contents of the Agile SDK Client-side components are:

Documentation

▫ *SDK Developer Guide* (this manual)

▫ API Reference files (these are the Javadoc generated HTML files that document the API methods)

▫ Sample applications

N o t e   The API HTML reference files and Sample applications are in the SDK_samples.zip folder. You can find this folder at http://www.oracle.com/technetwork/indexes/samplecode/agileplm-sample-520945.htm. For more information and procedures to access its contents, contact your system administrator, or refer to your PLM installation guide.

Installation

▫ Agile API library (`AgileAPI.jar`)

▫ Java Process Extensions API library (`pxapi.jar`)

▫ Apache Axis library (`axis.jar`)

Server-Side Components

Oracle's Agile Application Server contains the following SDK server-side components:

- Agile API implementation classes
- Java and Scripting process extensions framework
- Web service extensions frameworks

SDK Architecture

The SDK facilitates developing different types of programs to connect to the Agile Application Server. If you are using only the Agile APIs, these programs connect directly to the server. For information to develop these types of programs, refer to *SDK Developer Guide - Using Agile APIs*.

If you are using WSX to develop Web service extensions, you can deploy the Web services inside the Agile Application Server container. The Web server used for WSX is accessible from inside or outside the company's demilitarized computing zone (DMZ) or perimeter network. Information for developing Web service extensions is provided in this document.

When the Agile PLM Client initiates a custom action, it either runs a program that is deployed on the server, or connects to an external resource such as a URL. WSX, Java PX and Script PX extensions can also use the Agile APIs. You can develop extensions using APIs that are not provided by Agile. This information is also provided in this document.

Figure 1: Agile SDK architecture
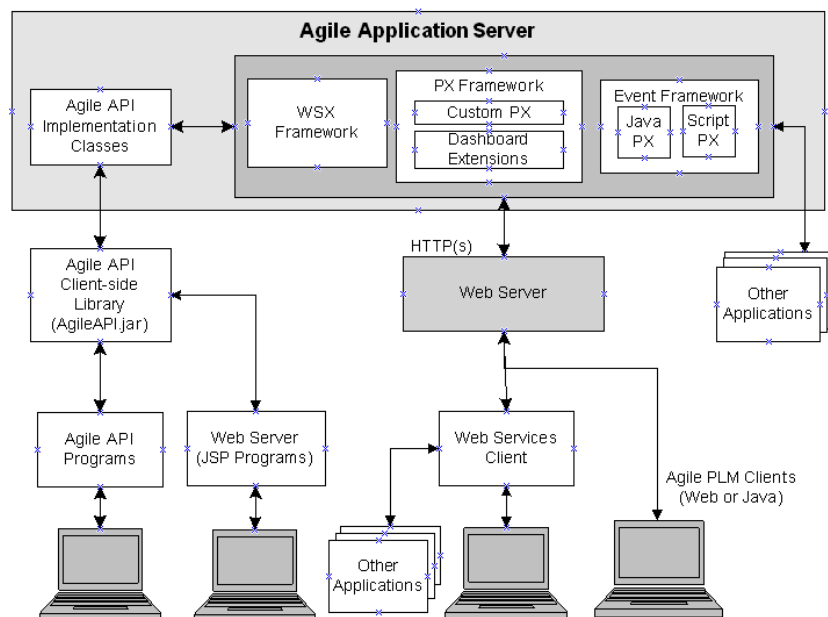
Note   Agile API programs connect to the Agile Application Server using non-secure means. Consequently, it is recommended that you run the Agile API programs only from within the corporate firewall. Web service Clients, however, can connect to the server through the corporate firewall using standard HTTP(S) technology.

System Requirements

For Agile SDK system requirements, refer to *PLM Capacity Planning and Deployment Guide*.

Java Requirements

The Agile API must be compatible with the version of Java that the application server supports. To avoid problems, an Agile API Client must use the same version of Java that the connecting application server is using. WebLogic Server 10.3 must use Sun Java Runtime Environment (JRE) 1.6 for interoperability and 2007 Daylight Saving Time compliance.

Important	SDK code running under JRE 7 cannot connect to a Proxy URL protected by SSO. To establish this connection, you must directly connect your SDK code to server nodes with actual Weblogic ports, or setup a second proxy that is not protected by SSO.

The following table lists the recommended Java Runtime Environment (JRE) to use with Agile API Clients on different application servers that Agile PLM supports.

Application Server	Operating System	Required Java Version for Agile API clients
Oracle WebLogic Server 10.3	Windows 2003	Sun JRE 1.6

JVM Parameters for Preventing Out of Memory Exceptions

To prevent out of memory errors, add the following Java Virtual Memory (JVM) parameter options in the indicated locations.

Note	This workaround is only applicable to single-threaded SDK programs.

- If the Client is a standalone SDK Client, add the JVM option as shown below:
  ```
  java -Ddisable.agile.sessionID.generation=true pk.sample
  ```

- If the Client is a PX and out of memory occurs in Agile Server, add the JVM option in
  ```
  < WLS_HOME>/opmn/conf/opmn.xml
  ```

  ```
  <category id="start-parameters">
          <data id="java-options" value="-Xrs -server -
  XX:MaxPermSize=256M -ms1280M -mx1280M -XX:NewSize=256M -
  XX:MaxNewSize=256M -XX:AppendRatio=3 -
  Doracle.xdkjava.compatibility.version=10.1.0 -
  Djava.security.policy=$ORACLE_HOME/j2ee/home/config/java2.policy  -
  Dagile.log.dir=$ORACLE_HOME/j2ee/home/log -
  Dcom.sun.management.jmxremote -
  Dcom.sun.management.jmxremote.port=9899 -
  Dcom.sun.management.jmxremote.authenticate=false -
  Dcom.sun.management.jmxremote.ssl=false -Djava.awt.headless=true -
  Dhttp.webdir.enable=false -Duser.timezone=GMT -
  Ddisable.agile.sessionID.generation=true"/>
          <data id="oc4j-options" value="-verbosity 10 -
  userThreads"/>
  ```

```
    </category>
```

▫ If the Client is a URL PX, add the following JVM option in the Server Start up (This is similar to `catalina.bat` in Tomcat.):

```
-Ddisable.agile.sessionID.generation=true
```

> **Note** For more information about URL Process Extensions, or URL PXs and especially, the Oracle-mandated security settings for these PXs, refer to *SDK Developer Guide – Developing PLM Extensions*.

Agile SDK Installation Folders

The Agile SDK files use the following folder structure on your computer:

`lib` – The `\`*agile_home*`\integration\sdk\lib` folder contains the following libraries:

> **Important** Do not include the `axis.jar` file and `AgileAPI.jar` file in the same `classpath`. The SDK classpath does not support this setting and the SDK will not function properly.

▫ `AgileAPI.jar` – Agile API library, which contains Agile API classes and interfaces

▫ `axis.jar` – An Oracle-modified version of the Apache Axis library required for Web service Clients

▫ `pxapi.jar` – PX API library, which contains interfaces used to develop custom autonumber sources and custom actions

Checking Your Agile PLM System

Before trying to run the Agile SDK Clients on your Agile PLM system, make sure the system is configured and working properly. In particular, make sure the HTTP ports for your application server are set correctly. For more information, refer to the *Agile PLM Installation Guide*.

Agile PLM Business Objects

With any enterprise software system, you work with business objects to manage the company's data. The following table lists the Agile PLM business objects and their related Agile API interfaces.

Object	Related Agile API Interface
Changes	`IChange`
Customers	`ICustomer`
Declarations	`IDeclaration`
Design	`IDesign`
Discussions	`IDiscussion`

Object	Related Agile API Interface
File Folders	`IFileFolder`
Items	`IItem`
Manufacturer parts	`IManufacturerPart`
Manufacturers	`IManufacturer`
Packages	`IPackage`
Part Groups (Commodity or Part Family)	`ICommodity`
Prices	`IPrice`
Product Service Request	`IServiceRequest`
Projects	`IProgram`
Sourcing Project	`IProject`
Quality Change Request	`IQualityChangeRequest`
Reports	`IProductReport`
Requests for Quote (RFQ)	`IRequestForQuote`
RFQ Responses	`ISupplierResponse*`
Sites	`IManufacturingSite`
Specifications	`ISpecification`
Substances	`ISubstance`
Suppliers	`ISupplier`
Transfer Order	`ITransferOrder`
User Groups	`IUserGroup`
Users	`IUser`

* Agile does not support the API interfaces in the current release of the software.

The business objects that you can view and actions that you can perform on these objects are determined by the server components installed on your Agile Application Server and the assigned privilege roles to that are assigned to your user account. Privilege levels can vary from field to field. In addition to Users and User Groups, Agile PLM administrators work with administrative objects, such as administrative nodes and Agile PLM classes.

Note   Not all Agile PLM business objects are exposed in the Agile API. For example, some Report objects are not accessible via the Agile API.

Developing Process Extensions

This chapter includes the following:

About Process Extensions

Process extension (PX) is a framework for extending the functionality of the Agile PLM system. The functionality can be server-side extensions, such as custom workflow actions and custom auto numbering, or extensions to client-side functionality, such as external reports or new commands added to PLM's Actions menu or the Tools menu. Regardless of the type of functionality that a process extension provides, all custom actions are invoked on the Agile Application Server rather than the local client.

Note   In addition to server-side functionalities that you can develop in the PX framework, Agile PLM's Event framework also supports developing extensions using Java and Groovy Script, called Java PXs and Script PXs respectively. Although you can migrate some of the custom actions developed in PX framework to Events framework, the two frameworks have their own unique interfaces and are not the same.

A process extension is either a Java class deployed on the Agile Application Server, or a link to a URL. The URL can be a simple Web site or the location of a Web-based application. Process extensions enable the Agile PLM server and Agile PLM users to connect to external systems. You can also use process extensions to add functionalities that are not provided by the standard Agile PLM client. Using a simple yet powerful approach, process extensions open the Agile PLM system, allowing you to tailor the application to your specific business requirements.

You can use process extensions to create:

□   Custom reports

□   User-driven and workflow-triggered custom actions

□   Custom tools accessible through Agile PLM clients

□   Custom auto numbering

Multiple process extensions can be linked together within a workflow, with each process extension performing a discrete business function. Process extensions can also be used to make requests to

Web services, such as services built with Agile's Web service extensions framework.

There are five integration points for process extensions available in Agile PLM clients. You can invoke process extensions from the following areas:

□ External reports

□ Actions menu

□ Tools menu

□ Workflow Status

□ Autonumber sources

The additive value, extensibility, and increased usability enabled by custom actions are innumerable. Oracle Consulting Services (OCS) can help your organization develop process extensions, including reporting, data import/export, process automation, validation, and other areas across different Agile modules (PC, PG&C, PPM, PCM, EC). For more information and to purchase these PXs, please contact your Oracle representative, Oracle Agile Consulting Services, or you can attend Process Extension training through Oracle University.

Developing Custom Autonumber Sources

This section describes how to develop a custom autonumber source.

Most Agile PLM object classes have at least one default autonumber source that lets you create a new object and automatically number it with the next number in the sequence. Autonumbers can have an alphanumeric prefix and/or suffix. You can also specify the length of the autonumber (a string) and which alpha-numeric characters to use.

Despite the flexibility that autonumbers provide, some companies have specific numbering requirements that can't be accommodated by Agile PLM's standard autonumbering capabilities. Such companies can define custom autonumber sources and add them to the Agile PLM system using the process extensions framework.

If you have administrator privileges, you can define autonumber sources in Agile Java Client. An autonumber source can use the client's standard numbering capabilities, or it can be associated with a custom autonumber source. When an Agile PLM client uses a custom autonumber source to create a new object, the Agile Application Server invokes the custom Java code to generate the number.

Defining a Custom Autonumber Source

To define a custom autonumber source, create a Java class that implements the `ICustomAutoNumber` interface, a server-side API in the `com.agile.px` package. The code should define the autonumbering logic, for example, prefix, suffix, number of digits, character set, and so on, and the persistence mechanism. Regarding persistence, the location where your custom autonumber source stores numbers is entirely up to your program. For example, you can store numbers in a SQL database like Oracle or in a file.

The Agile PLM server gets the next number from the custom autonumber source by calling the `getAutoNumber()` method, which must be provided in your class. The following example shows how to implement a Java class for a custom autonumber source.

Example: Defining the class for a custom autonumber source

```
package autonumbers;


import com.agile.px.*;
import com.agile.api.*;


public class ResistorNumber implements ICustomAutoNumber
{
    public ActionResult getAutoNumber(IAgileSession session, INode
    actionNode)
    {
        String num;
    // Write your code here to define the custom autonumber source for
    Resistors
    return new ActionResult(ActionResult.STRING, num);
    }
}
```

Packaging and Deploying a Custom Autonumber Source

After you develop classes for a custom autonumber source, follow these instructions to properly package and deploy them.

To package and deploy a custom autonumber source:

1.   Use your Java development environment or the Java Archive tool (or JAR tool) to create one or more JAR files for the custom autonumber source. Make sure the JAR file(s) includes a META-INF/services directory that contains a file named `com.agile.px.ICustomAutoNumber`, which is a text file that lists the fully qualified Java class names, one class per line, for the custom autonumber source.

     Multiple custom autonumber sources can be included in one package. For example, the `com.agile.px.ICustomAutoNumber` file could look like this:

     `autonumbers.ResistorNumber`

     `autonumbers.CapacitorNumber`

     `autonumbers.DiodeNumber`

Note	Paths within a JAR file are case-sensitive. Therefore, make sure the META-INF folder contained within the JAR file has a name with all uppercase or all lowercase characters. Otherwise, the custom autonumber source will not be deployed.

2. Place the JAR file(s) in the *agile_home*/integration/sdk/extensions folder on the same computer where the Agile Application Server is installed.

Note	If you have several application servers in a clustered environment, you must deploy process extension files on each server in the cluster.

Configuring Custom Autonumber Sources in Java Client

In Agile Java Client, you can define autonumber sources in the Admin module. To configure Agile PLM system settings, you must have an administrator account.

To add a custom autonumber source:
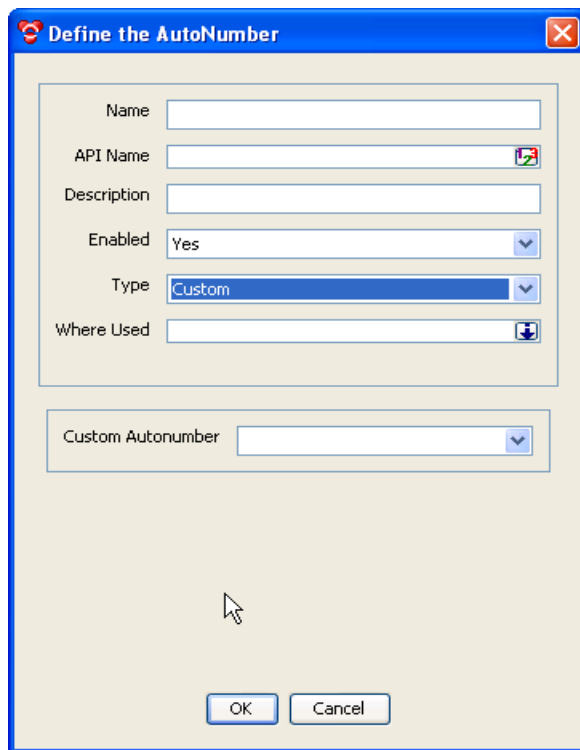
1. Log in to Agile Java Client as an administrator.

2. Click the **Admin** tab.

3. Go to **Settings > Data Settings** > **AutoNumbers**.

4. Click the **AutoNumbers** node.

5. In the AutoNumbers window, click [icon]. The Define the Autonumber dialog box appears.

Figure 2: Define the Autonumber dialog box

6. Provide the following information:

    *   **Name** – Type the name of the autonumber source.

    *   **API Name** – This field is automatically filled in after completing the Name field. Refer to Accessing PLM Metadata with APIName Field in *SDK Developer Guide - Using the APIs.*

    *   **Description** – Type a brief description of the autonumber source.

    *   **Enabled** – Select **Yes** or **No.**

    *   **AutoNumber type** – Select Custom. This activates the Custom AutoNumber field.

    *   **Where Used** – Select the subclass(es) that can use this autonumber source.

- **Custom AutoNumber** – Select a custom autonumber source from the list (this is where your class should appear).

7.   Click **OK** to save the autonumber definition.

Assigning Autonumber Sources to a Subclass

When you define an autonumber source, you can specify the subclasses where it's used in the Where Used field. You can also assign an autonumber source to a subclass in the Classes node.

To assign autonumber sources to a subclass:

1.   Log in to Agile Java Client as an administrator.

2.   Click the **Admin** tab.

3.   Open the **Data Settings** folder.

4.   Open the **Classes** node.

5.   In the Classes window, double-click a subclass. The subclass window appears.

6.   In the Autonumber Source field, click ↓. A popup window appears.

7.   Select autonumber sources in the Choices list, and then click > to move them into the Selected list. When you are finished, click **OK**.

8.   Click **Save** to save settings.

Developing Custom Actions

This section describes how to develop custom actions in Java classes. The Agile PLM clients can make direct method calls to these classes to perform the actions.

You can initiate a custom action from the following areas of Agile PLM clients:

- Actions menu
- Tools menu
- External reports
- Workflow Status

Defining a Custom Action

To define a custom action, create a Java class that implements the `ICustomAction` interface, a server-side API in the `com.agile.px` package. The code should define the action to perform. The Agile PLM server initiates the action by calling the `doAction()` method, which must be provided in your class.

The following example shows the code for a HelloWorld class. When the `doAction()` method is called, the method returns "Hello World." If you invoke the HelloWorld custom action from Actions menu, the string "Hello World" will be logged to the object's History table. If you invoke the HelloWorld custom action from a workflow, the string "HelloWorld" will be logged to the change order's History table when it enters the appropriate Workflow status.

Example: Defining a HelloWorld class for a custom action

```
package actions;

import com.agile.px.*;
import com.agile.api.*;

public class HelloWorld implements ICustomAction
{
    public ActionResult doAction(IAgileSession session, INode
    actionNode,
            IDataObject affectedObject)
    {
        return new ActionResult(ActionResult.STRING, "Hello World");
    }
}
```

The above HelloWorld class does not perform a useful action, it simply demonstrates how to implement the class for a custom action.

Formatting New Lines (Line Breaks) in PLM Clients

You can configure new lines in `ActionResult` outputs in Web and Java clients using the `'\n'` character.

Note   SDK only supports the character `'\n'` for new lines in both Web and Java clients.

Example: Formatting new lines in SDK string outputs

1.   Create a Process Extension that includes with the following `ActionResult` string.

```
return ActionResult(ActionResult.STRING, "Hello \n This example tests
formatting new lines \n in the SDK");
```

2.   Run the Process Extension in the Web and Java clients from Actions menu and Tools menu.

The output should be as below

```
Hello
This example tests formatting new lines
in the SDK
```

Custom Actions and User Sessions

When an Agile PLM client invokes a process extension, it does so within the current user's session. Therefore, the process extension should not create any additional `IAgileSession` objects using the Agile API within the process extension code or any code directly invoked from the process extension. Stated simply, process extensions never directly create new Agile PLM sessions.

If you have written a Web service extension (WSX) and want to make use of that code from within a process extension, you can directly invoke Java methods contained in WSX classes without using the Web services infrastructure, provided those methods do not create a new `IAgileSession` object.

Do not mix Process extension (PX) invocations with Web service extension (WSX) invocations. The PX code must not invoke any WSX code directly, especially when the PX and WSX reside in the same application container. If a process extension makes use of Web services, that WSX will likely create a new Agile PLM session, which is distinct from the session used by the process extension.

URL-based process extensions can call an external application that communicates with the Agile PLM server and performs some action upon the currently selected business object. To perform such an action, the external application can use the Agile API to create another Agile PLM session. For more information, see Creating an Agile PLM Session from the Target System on page 22.

Packaging and Deploying a Custom Action

After you develop classes for a custom action, follow these instructions to properly package and deploy them.

To package and deploy a custom action:

1. Use your Java development environment or the Java Archive tool (or JAR tool) to create one or more JAR files for the custom action. Make sure the JAR file(s) includes a META-INF/services directory that contains a file named `com.agile.px.ICustomAction`, which is a text file that lists the fully qualified Java class names, one class per line, for the custom action.

    Multiple custom actions can be included in one package. For example, the `com.agile.px.ICustomAction` file could look like this:

    `actions.HelloWorld`

    `actions.RFQConsolidation`

    `actions.RefreshCustomerFromCRM`

    `actions.StartMfg`

    `actions.ObsoletePartReplacer`

    `actions.WorkflowConflictResolver`

    Note   Paths within a JAR file are case-sensitive. Therefore, make sure the META-INF folder contained within the JAR file has a name with all uppercase or all lowercase characters. Otherwise, the custom action will not be deployed.

2. Place the JAR file(s) in the *agile_home*/integration/sdk/extensions folder on the same computer where the Agile Application Server is installed.

    Note   If you have several application servers in a clustered environment, you must deploy process extension files on each server in the cluster.

Roles and Privileges for Custom Actions

When you configure a custom action in Agile Java Client, you can specify the roles it uses. By default, a custom action uses the roles of the current user. However, you can configure a custom action to have expanded privileges. This is an important feature of process extensions. In effect, you can enforce the business logic of a custom action by granting it more privileges than those given to ordinary users. When a custom action is invoked in the Agile PLM client, its roles and privileges contained within the roles override the privileges of the current user. Once the custom action is completed, the client reverts to the user's privileges.

User Privileges for Configuring Process Extensions

To configure a Process Extension, you must have necessary user privileges to get the user's language setting. If a PX fails, the error message should display in the user's current language. If the user's roles are not set to include the privilege to load current user object info, the server will display all messages in the default system language.

Configuring Custom Actions in Agile Java Client

In Agile Java Client, you can define custom actions in the Admin module. To configure Agile PLM system settings, you must log in as a user with administrator privileges.
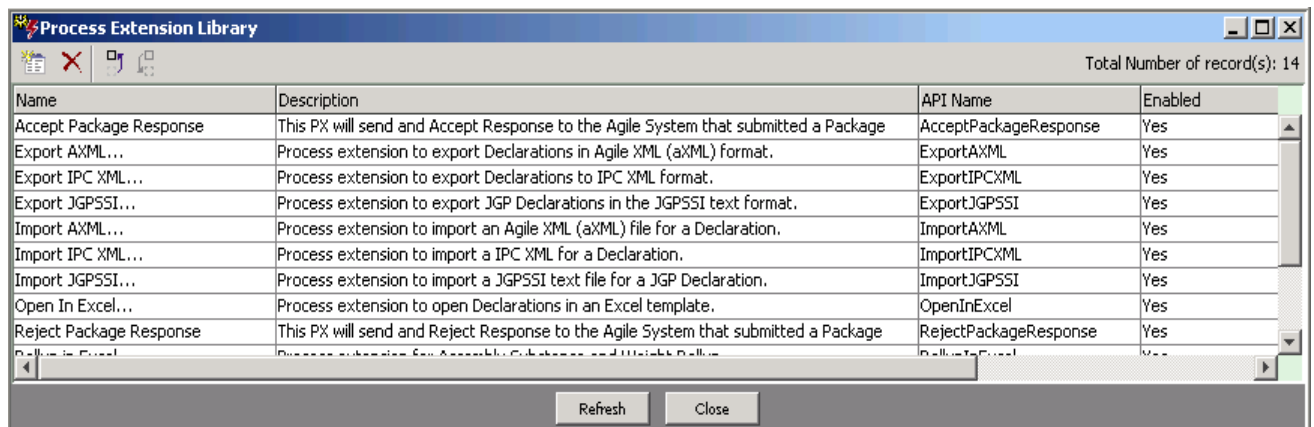
Using the Process Extension Library

The Process Extension Library is where you define the custom actions that can be used in Agile PLM clients. When you add a custom action to the Process Extension Library, you specify how to initiate that action from the client.

To add a custom action to the Process Extension Library:

1. Log in to Agile Java Client as an administrator.

2. Click the **Admin** tab.

3. Open the **Data Settings** folder.

4. Open the **Process Extensions** node.

Figure 3: The Process Extension Library

Name	Description	API Name	Enabled
Accept Package Response	This PX will send and Accept Response to the Agile System that submitted a Package	AcceptPackageResponse	Yes
Export AXML...	Process extension to export Declarations in Agile XML (aXML) format.	ExportAXML	Yes
Export IPC XML...	Process extension to export Declarations to IPC XML format.	ExportIPCXML	Yes
Export JGPSSI...	Process extension to export JGP Declarations in the JGPSSI text format.	ExportJGPSSI	Yes
Import AXML...	Process extension to import an Agile XML (aXML) file for a Declaration.	ImportAXML	Yes
Import IPC XML...	Process extension to import a IPC XML for a Declaration.	ImportIPCXML	Yes
Import JGPSSI...	Process extension to import a JGPSSI text file for a JGP Declaration.	ImportJGPSSI	Yes
Open In Excel...	Process extension to open Declarations in an Excel template.	OpenInExcel	Yes
Reject Package Response	This PX will send and Reject Response to the Agile System that submitted a Package	RejectPackageResponse	Yes

Total Number of record(s): 14

5. In the Process Extension Library window, click the Add Process Extension button ⬚ to open the Add Process Extension dialog box.

Figure 4: The Add Process Extension dialog
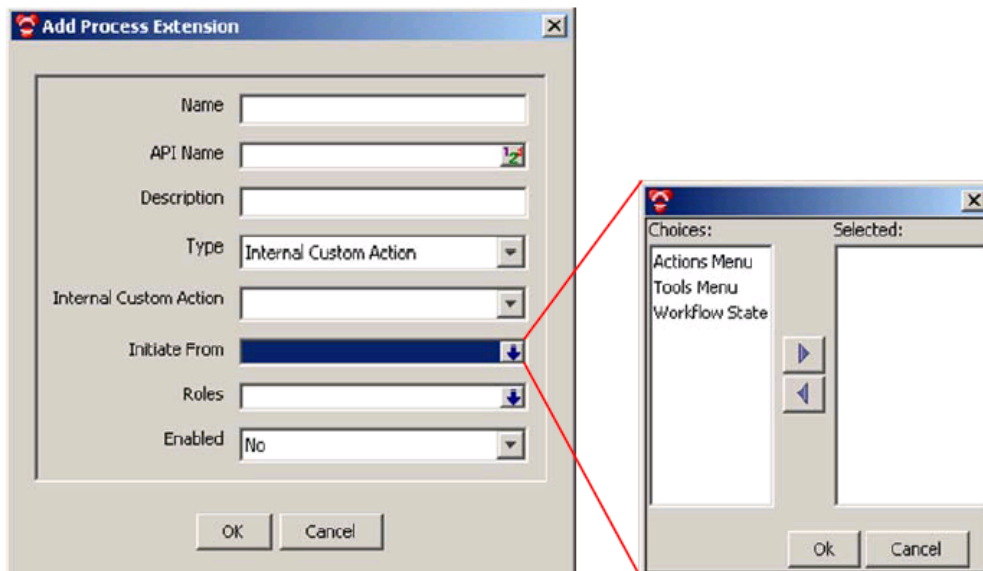
6. Type the following information:

- **Name** – Type the name of the process extension.

- **API Name** – This field is automatically filled in after completing the Name field. Refer to Accessing PLM Metadata with APIName Field in *SDK Developer Guide - Using the APIs*.

- **Description** – Type a brief description of the process extension.

- **Type** – Select Internal Custom Action. This activates the Internal Custom Actions field.

- **Internal Custom Action** – Select a custom action from the list (your classes should appear here).

- **Initiate From** – Select one or more locations from which the process extension can be initiated. Choose from the following options:

▫ **Actions menu** – Allows you to select the custom action from the Actions menu of a properly configured class.

▫ **External report** – Allows you to generate a report by accessing an external resource or URL. If the process extension is an internal custom action, the External Report option is unavailable.

▫ **Tools menu** – Allows you to select the custom action from the Tools menu.

▫ **Workflow status** – Invokes the custom action whenever a properly configured workflow enters a particular status.

If you specify that a process extension is initiated from the Actions menu or a workflow status, you can configure subclasses or workflows to use it. If you specify that a process extension is used to generate an external report, you can use Agile Web Client to create the report. If you specify that a process extension is initiated from the Tools menu, it is always available in the Agile PLM client.

- **Roles** – Select one or more roles to use for the custom action. To use the roles of the current user, leave this field blank. To temporarily override roles of the current user, select one or more roles. Once the custom action is completed, the client reverts to the current user's roles.
- **Enabled** – Select Yes or No.

7. Click **OK** to save the new process extension.

Assigning Process Extensions to Classes

To add custom actions to the Actions menu of an Agile PLM object (such as a Part or an ECO), you configure the object's class. Each base class, class, and subclass has a Process Extensions tab. The custom actions that you assign to a class must be previously defined in the Process Extension Library.

Process Extensions are inherited from classes and base classes. Consequently, if you assign a process extension to a base class, it is also assigned to classes and subclasses beneath the base class.

Note Process extensions can be assigned to only one level in a class hierarchy. For example, if a process extension is assigned to the Part subclass, it can't be assigned to the Item base class.

To assign process extensions to a class:

1. Log in to Agile Java Client as an administrator.

2. Click the **Admin** tab.

3. Open the **Data Settings** folder.

4. Open the **Classes** node.

5. In the Classes window, double-click a base class, class, or subclass.

6. Click the **Process Extensions** tab.

7. In the toolbar, click ![icon]. The Assign Process Extension dialog box appears.

8. Select custom actions in the Choices list, and then click ![button] to move them into the Selected list. When you are finished, click **OK**.

9. Click **OK** to save settings.

Assigning Process Extensions to Workflow Statuses

For each workflow status except the Pending status, you can assign one or more custom actions that are initiated when the workflow enters that status. The custom actions you assign to a workflow status must be previously defined in the Process Extension Library.

Note Automated Transfer Orders (ATOs) do not support workflow-triggered process extensions.

To assign process extensions to a workflow status:

1. Log in to Agile Java Client as an administrator.

2. Click the **Admin** tab.

3. Open the **Workflow Settings** folder.

4. Open the **Workflows** node.

5. In the Workflows window, double-click a workflow.

6. Click the **Status** tab.

7. Select a status other than Pending. The selected status updates the Workflow Criteria properties table that appears below the status table.

8. Double-click the selected status criterion in the Workflow Criteria properties table.

9. In the Process Extensions list, click [↓]. A popup window appears.

10. Select custom actions in the Choices list, and then click [>] to move them into the Selected list. When you are finished, click **OK**.

11. Click **Save** to save settings.

Defining and Deploying URL-Based Process Extensions

URL-Based Process Extensions are used by Agile Web Client to provide access from the Web Client to external applications. When the Agile PLM Web Client invokes a process extension that references a URL, the client displays the Web page in a new browser window.What types of Web-based applications could be used for URL-based process extensions? Again, there are few limitations. One example might be a Web-based application that performs business rules validation for an Agile PLM object and updates the object accordingly. The following figure shows the program flow of such a process extension.

Figure 5: Process flow for a URL-based process extension
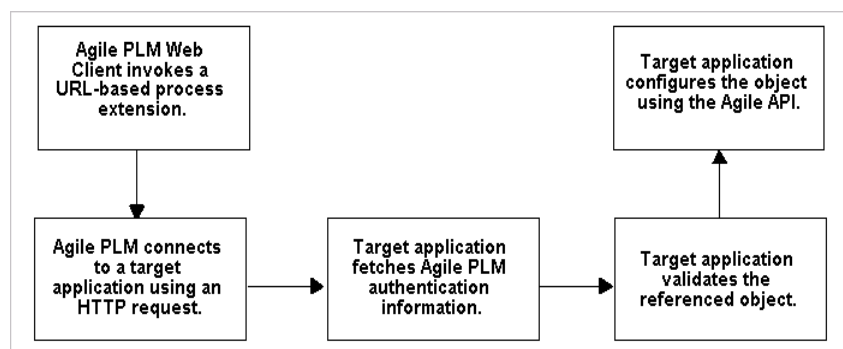
You can also use URL-based process extensions to reference a Web-based report engine. To create an external report that uses a URL-based process extension, choose **Create > Report > External** in Agile Web Client. For more information, see Creating an External Report on page 26.

Note   Agile Java Client does not support URL PXs.

Before Building a URL-Based Process Extension

Please note the following requirements and constraints when building a URL-based process extension:

❑ URL-based process extensions cannot be initiated by a change in a workflow, because an Agile PLM client may not be active to trigger the change in status

❑ URL-based process extensions are not supported for Sourcing projects (`IProject`)

Defining a URL-Based Process Extension

To define a URL-based process extension do as follows:

1. Log into the Agile Java Client as an administrator.

2. Click the **Admin** tab.

3. Open the **Data Settings** folder.

4. Open the **Process Extensions** node.

5. In the Process Extension Library window, click . The Add Process Extension dialog box appears.

6. Enter the following information:

   - **Name** — Type the name of the process extension.

   - **Description** — Type a brief description of the process extension.

   - **Type** — Select the URL.

   - **Address** — Specify the address of a Web page. You must specify the complete URL, including the protocol. For example, to specify the Oracle Corporation Web site, you would type "http://www.oracle.com", not "www.oracle.com".

   - **Initiate From** — Select one or more locations from which the Web page can be initiated. Choose from the following options:

     - **Actions menu** — Allows you to select the Web page from the Actions menu of a properly configured class.
     - **Dashboard** — See Developing Dashboard Management Extensions.
     - **External report** — Use this to generate a report by accessing the Web page.
     - **Tools menu** — Use this to select the Web page from the Tools menu.

     If you specify that a process extension is initiated from the Actions menu, you can configure subclasses to use it. If you specify that the process extension is used to generate an external report, you can use the Agile Web Client to create the report. If you specify that the process extension is initiated from the Tools menu, it is available at all times in the Agile PLM client.

   - **Enabled** — Select **Yes** or **No**.

7. Click **OK** to save the new process extension.

Setting Cookie Expiration Properties for URL Process Extensions

Navigating the URL PX generates a Cookie, and once created, the Cookie can be reused to intrude the PLM System. The Cookie Expiration feature is implemented to protect the PLM System from harmful intrusion by unauthorized user. This feature generates a unique token that is passed inside the `j_password` cookie which can be used only once. The following two attributes in the `agile.properties` file control the settings for these properties:

- `agile.sso.checkOneTimePXToken` – This property is used to enable/disable the feature.

- `agile.sso.expirationTime` – This property controls the duration of the token and once the set duration expires, the token is invalidated and the Cookie is no longer reusable.

The default settings for these properties are (`true`) and 120 seconds respectively, and the PLM Administrator can reset both properties:

- `agile.sso.checkOneTimePXToken = 'true'`

- `agile.sso.expirationTime = 120`

Passing Encoded Agile PLM Information to Other Applications

Note   Agile SDK does not support single sign-on via password protected external application servers. However, Agile Web Client can propagate encoded user credentials, and the SDK can reuse these credentials when your PX application uses the Agile SDK. If you want to password protect access to an external Application Server, you must hard code the username and password to access the external servlet into your code.

If a URL-based process extension is initiated from an object's Actions menu, the object's composite key and class ID, as well as the current username, are encoded in the URL using the **GET** method. The client encodes the data as ID=value pairs and appends it to the end of the URL. Each ID is prefixed with "agile," as shown in the following example.

```
http://www.acoolwebsite.com/?agile.username=wangsh&agile.classId=10141&
agile.1001=
```
➡ `1000-02&agile.1014=A&agile.siteName=Taipei`

Note   Unlike the Actions menu, there isn't an Agile PLM object associated with commands on the Tools menu. Consequently, if a URL-based process extension is initiated from the Tools menu, the URL is not augmented with encoded object data.

In addition to information encoded in the URL of a URL-based process extension, the encrypted username and its associated password are available from the j_username and j_password cookies, respectively, which are automatically passed to the target system if the following conditions are met:

- The user initiates a URL-based process extension from Agile Web Client.

Note   Your Web application must reside in the domain specified in the cookie.domain property of agile.properties. Otherwise, security cookies will not propagate.

- The target system is permitted to receive cookies.

❑   The target system is in the same domain as the Agile PLM system.

Note	If the target system is located outside the company firewall, it should be a secure Web server using SSL.

Creating an Agile PLM Session from the Target System

Using authentication information contained in the HTTP request received from a URL-based process extension initiated from Agile Web Client, the target application can use the Agile API to create an `IAgileSession`. The Agile API client can then retrieve and configure the Agile PLM object referenced by the HTTP request.

When a user logs into Agile Web Client, the authentication process creates a pair of cookies (`j_username` and `j_password`) on the server computer that store the user's encrypted user name and password.

Note	These cookies will expire after the duration set by the Agile PLM Administrator.

When you initiate a URL-based process extension from Agile Web client, the target system can use cookies to create an Agile PLM session. In effect, Agile Web client and the Agile API client on the target system can share a single sign-on.

Note	The Agile Java Client, unlike the Web client, does not create client-side cookies. Therefore, it does not support the single sign-on feature for process extensions.

Cookies are designed to be shared among computers within the same domain. For example, if during installation of Agile PLM, you configure the domain to be ".agile.agilesoft.com", then all computers ending with "`.agile.agilesoft.com`" can use the `j_username` and `j_password` cookies.

For more information, see http://cookiescache.tripod.com/.

The following example shows how to use the Agile API to extract cookie information from the HTTP servlet request and use that information to generate an `IAgileSession`. The value of the `AgileSessionFactory.PX_REQUEST` field, which is the key used to create the session, is set to be equal to the servlet request.

Example: Creating an IAgileSession from a servlet request using the PX_REQUEST field

```
private IAgileSession connect(HttpServletRequest request) throws
ServletException {
  factory =
AgileSessionFactory.getInstance("http://agileserver/Agile");
  HashMap params = new HashMap();
  params.put(AgileSessionFactory.PX_REQUEST, request);
  session = factory.createSession(params);
  return session;
}
```

If the target application is not servlet-based, there is another way to use the cookie information to create a session. Rather than using `AgileSessionFactory.PX_REQUEST`, you can use `AgileSessionFactory.PX_USERNAME` and `AgileSessionFactory.PX_PASSWORD` fields as keys for the HashMap. The values of these fields should be the values of the j_username and j_password cookies, respectively.

Example: Creating an IAgileSession using PX_USERNAME and PX_PASSWORD fields

```
private IAgileSession connect(Cookie[] cookies) throws Exception {
  factory =
AgileSessionFactory.getInstance("http://agileserver/Agile");
  HashMap params = new HashMap();
  String username = null;
  String pwd = null;
  for (int i = 0; i < cookies.length; i++) {
    if (cookies[i].getName().equals("j_username"))
      username = cookies[i].getValue();
    else if (cookies[i].getName().equals("j_password"))
      pwd = cookies[i].getValue();
  }
  params.put(AgileSessionFactory.PX_USERNAME, username);
  params.put(AgileSessionFactory.PX_PASSWORD, pwd);
  session = factory.createSession(params);
  return session;
}
```

Retrieving an Agile PLM Object from an HTTP Request

If you invoke a URL-based process extension from an object's Actions menu, you may want the target application to retrieve the Agile PLM object and modify it. The object's composite key and class ID are encoded in the URL using the `GET` method. To make it easier for the target application to retrieve the referenced `IAgileObject`, the Agile API provides an overloaded use of the `IAgileSession.getObject()` method, as shown in the following example. The SDK extracts the object ID information from the request and uses it to retrieve the specified object.

Example: Retrieving an Agile PLM object from an HTTP request

```
private IAgileObject getAgileObject(HttpServletRequest request) throws
ServletException {
    IAgileObject obj = session.getObject(null, request);
    return obj;
}
```

If the target application is not servlet-based, you can use the normal `IAgileSession.getObject()` methods to retrieve the referenced object. For the `params` parameter of `getObject()`, specify a HashMap containing all required attributes for the object's class; the necessary attribute/value pairs are contained in the encoded URL. For a list of identifying attributes for each Agile PLM class, see the following section.

Identifying Attributes for Agile PLM Classes

Each Agile PLM class has a different set of identifying attributes that could be passed as parameters in an encoded URL. For example, a Change object would pass its class ID and Cover Page.Number attribute. The following table lists the identifying attributes for each Agile PLM class.

Class	Parameter	Description
Change	`agile.classID`	Class ID of selected object
	`agile.1047`	Cover Page.Number
Customer	`agile.classID`	Class ID of selected object
	`agile.5110`	General Info.Customer Number
Commodity	`agile.classID`	Class ID of selected object
	`agile.agile.2000 004284`	Title Block.Name
Declaration	`agile.classID`	Class ID of selected object
	`agile.agile.2000 002615`	Title Block.Name
Discussion	`agile.classID`	Class ID of selected object
	`agile.18417`	Cover Page.Number
File Folder	`agile.classID`	Class ID of selected object
	`agile.6173`	Title Block.Number
	`agile.7951`	Title Block.Version
Item	`agile.classID`	Class ID of selected object
	`agile.1001`	Title Block.Number
	`agile.1014`	Title Block.Rev
	`agile.siteName`	Site name — If All is selected, this parameter is omitted
Manufacturer Part	`agile.classID`	Class ID of selected object
	`agile.1647`	General Info.Manufacturer Name
	`agile.1648`	General Info.Manufacturer Part Number
Manufacturer	`agile.classID`	Class ID of selected object
	`agile.1754`	General Info.Manufacturer Name
Package	`agile.classID`	Class ID of selected object
	`agile.3110`	Cover Page.Package Number
Price	`agile.classID`	Class ID of selected object
	`agile.10355`	General Information.Number
	`agile.10357`	General Information.Rev

Class	Parameter	Description
Program	`agile.classID`	Class ID of selected object
	`agile.18041`	General Info.Number
Sourcing Project	`agile.classID`	Class ID of selected object
	`agile.14824`	General Info.Number
PSR	`agile.classID`	Class ID of selected object
	`agile.4856`	Cover Page.Number
QCR	`agile.classID`	Class ID of selected object
	`agile.4029`	Cover Page.QCR Number
Report1	`agile.classID`	Class ID of selected object
	`agile.8071`	General Info.Name
RFQ	`agile.classID`	Class ID of selected object
	`agile.13925`	CoverPage.RFQ Number
RFQ Response	`agile.classID`	Class ID of selected object
	`agile.14472`	CoverPage.RFQ Number
	`agile.14452`	CoverPage.SupplierName
Site	`agile.classID`	Class ID of selected object
	`agile.11882`	General Info.Name
Specification	`agile.classID`	Class ID of selected object
	`agile.2000001969`	Title Block.Name
Substances	`agile.classID`	Class ID of selected object
	`agile.2000001124`	Title Block.Name
Supplier	`agile.classID`	Class ID of selected object
	`agile.17761`	General Info.Number
Transfer Order	`agile.classID`	Class ID of selected object
	`agile.12673`	Cover Page.Transfer Order Number
User	`agile.classID`	Class ID of selected object
	`agile.11617`	General Info.Username
User Groups	`agile.classID`	Class ID of selected object
	`agile.12077`	General Info.Name

Note Although the process extensions framework can encode Report information in a URL, Report objects are not supported by the Agile API. Therefore, you cannot use the Agile API to retrieve Report objects referenced in a URL.

Creating an External Report

In Agile Web Client, you can connect to an external resource or URL to generate an external report. Before you create an external report, you must add the URL associated with the report to the Process Extension Library. For more information, see Defining URL-Based Process Extensions on page 20.

To create reports in Agile Web Client, you must have the Create Reports privilege.

To create an external report:

1. Log in to Agile Web Client.

    > **Note**   You cannot create external reports in Agile Java Client.

2. Choose **Create > Report > External**. The Report Creation Wizard appears.

3. Type the name of the report. Click **Next**.

4. Type the following General Information:

    -   **Description** – Type a brief description of the report.
    -   **Process Extension** – Select a process extension. The process extension you select is associated with a URL, such as the location of Web-based report engine.
    -   **Folder** – Select the report's parent folder.

5. Click **Finish**.

Deploying Process Extensions in Clustered Environments

If the Agile PLM installer was not run on a server in the application server cluster, the /*agile_home*/`integration/sdk/extensions` folder will not exist on that server. In this case, you must create the folder manually and copy any process extension JAR files into that folder as shown below.

To manually create deployment folders for process extensions:

1. Create the following folder on all application servers in the cluster (if it does not exist): /*agile_home*/`integration/sdk/extensions`

2. Load all process extension JAR files in the /*agile_home*/`integration/sdk/extensions` folder on each server in the cluster.

Best Practices for Copying third Party JAR Files

If your PX code uses 3rd party JAR files such as `axis.jar,` you can copy them in the shared library and add them to `classpath` using the following procedures.

Use te following procedure to configure your shared libraries

To deploy the 3rd party JAR files on WebLogic:

1. Stop all servers in the domain.

2. Copy the shared JAR file(s) to the `lib` subdirectory of the domain directory.

   For example, `cp c:\3rdpartyjars\utility.jar` *`AGILE_HOME`*`\agileDomain\lib`

Note	The WebLogic Server must have read access to the `lib` directory during startup.
Note	The Administration Server does not automatically copy files in the `lib` directory to Managed Servers on remote machines. If you have Managed Servers that do not share the same physical domain directory with the Administration Server, you must manually copy the JAR file(s) to the `domain_name/lib` directory on the Managed Servers.

3. Start the Administration Server and all Managed Servers in the domain. WebLogic Server appends JAR files found in the lib directory to the system classpath. Multiple files are added in alphabetical order.

To deploy the dependent JAR files from a WebLogic Admin console:

1. In WLS Administration console, select **Deployments > Control > Install**.

Figure 6: WebLogic Sever's Admin Console
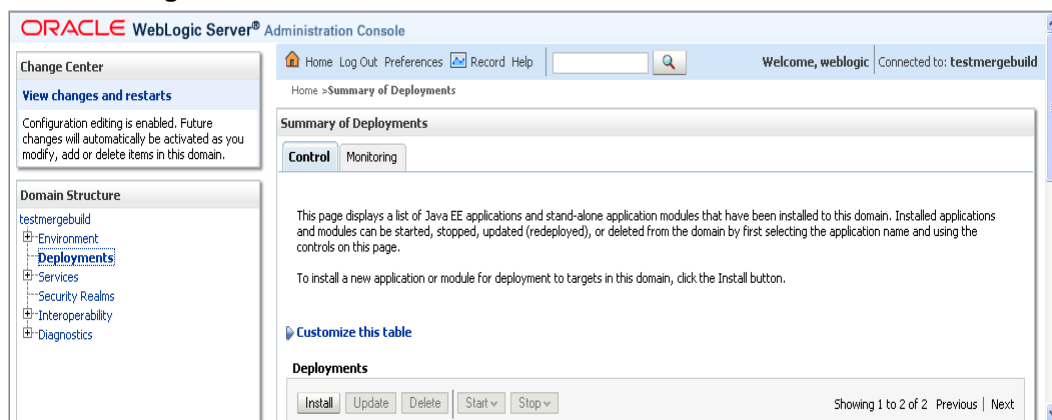
2. Select the JAR file and then click **Next**.

Figure 7: WebLogic's file selection dialog
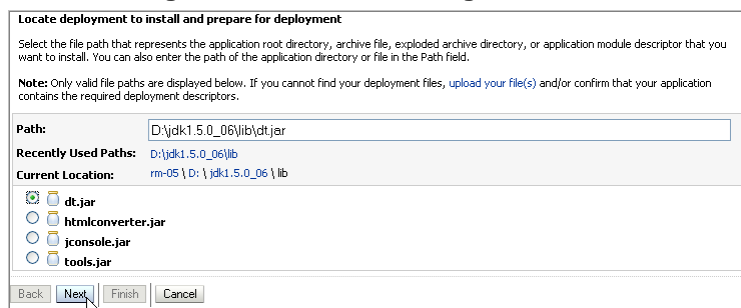
3. In Install Application Assistant accept the default settings and click **Finish**.
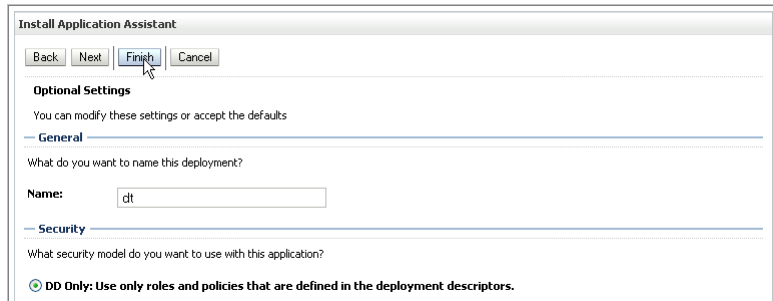
4. Make sure the library pointed to the Agile Server/cluster.

5. Create a file called `weblogic-application.xml` with the following content:

```
<?xml version="1.0" encoding="UTF-8"?>

          <wls:weblogic-application
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xmlns:wls=http://www.bea.com/ns/weblogic/weblogic-
          application
          xsi:schemaLocation="http://www.bea.com/ns/weblogic/weblogi
          c-application http://www.bea.com/ns/weblogic/weblogic-
          application.xsd http://java.sun.com/xml/ns/j2ee
          http://java.sun.com/xml/ns/j2ee/j2ee_1_4.xsd">

          <wls:library-ref>

            <wls:library-name><Shared Library Jar file
          name></wls:library-name>

     </wls:library-ref>

</wls:weblogic-application>
```

6. Place the `weblogic-application.xml file in`
   `Agile_Home\agiledomain\applications\application.ear\META-INF` folder in the
   Administration server.

7. Restart the Administration and all the Managed servers.

To deploy the properties files on WebLogic:

1. Stop all servers in the domain.

2. Copy the properties file(s) to a directory as in `AGILE_HOME/pxConfig` in each server.

Note	WebLogic Server must have read access to the directory during startup.
Note	The Administration Server does not automatically copy files in the directory to Managed Servers that are on remote machines. If you have Managed Servers that do not share the same physical domain directory that is used by the Administration Server, you must manually copy the properties files to the `AGILE_HOME/pxConfig` directory on the Managed Servers.

3. Add the directory containing the properties file(s), for example, *AGILE_HOME*/pxConfig to the WebLogic CLASSPATH as shown below:

    a. Edit *AGILE_HOME*/agileDomain/bin/setEnv.bat in all Managed Servers

    b. Add **AGILE_HOME/pxConfig** folder to the CLASSPATH
    ```
    set CLASSPATH=%JAVA_HOME%/lib/tools.jar
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/ojdbc14.jar
    setCLASSPATH=%CLASSPATH%;%WLS_HOME%/server/lib/
        weblogic_sp.jar;%WLS_HOME%/server/lib/weblogic.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/agbase.jar
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/wlsauth.jar
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/crypto.jar
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/xercesImpl.jar
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/jdom.jar;
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/log4j.jar;
    set CLASSPATH=%CLASSPATH%;%LIB_HOME%/jobaccess.jar;
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/colt.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/jms.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/jndi.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/tibjms.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/oc4jclient.jar
    set ClASSPATH=%CLASSPATH%;%LIB_HOME%/oc4j.jar
    set CLASSPATH=%CLASSPATH%;../ldaplib/ldaputil.jar
    set CLASSPATH=%CLASSPATH%;D:\Agile931b28/agileDomain/config
    set CLASSPATH=%CLASSPATH%;AGILE_HOME/pxConfig
    ```

4. Start the Administration Server and all Managed Servers in the domain.

Process Extensions FAQs

This section answers common questions about process extensions.

What are process extensions?

Process extensions extend the functionality of Agile PLM clients through custom actions, external reports, and custom autonumbering, thus tailoring the system to fit a customer's business. Process extensions can be used to connect the Agile PLM server and Agile PLM users to external systems.

What types of actions can you define with process extensions?

Process extensions support two types of process extensions actions. They are custom autonumber sources and custom actions. Custom autonumber sources define the numbering sequences used by classes of objects. Custom actions are programs that can be run from Agile PLM clients.

A process extension can also be a reference to a URL. The URL can be a simple Web site or the location of a Web-based application.

Can Process Extensions support asynchronous operations?

Agile Process Extensions only support synchronous operations. If your Process Extension requires asynchronous behavior, you must modify your PX code to implement asynchronous solutions of your choice. For example, you can spawn a thread.

Can I use Agile's Java API within a process extension program?

Yes. You can use Agile's Java API and other external Java APIs. The only requirement is that you implement either the `ICustomAutoNumber` or the `ICustomAction` interface, depending on the type of extension.

How do you initiate a process extension in an Agile PLM client?

Custom actions can be triggered in the following ways:

▫ A change to a Workflow status.

▫ Selecting a custom action from the Tools menu.

▫ Selecting a custom action from the object's Actions menu.

▫ Selecting an external report that uses a custom action.

▫ Creating an object of a class that uses a custom autonumber source.

Do process extensions have special security requirements?

No. The process extensions stack sits on the Agile Application Server, so custom actions and custom autonumber sources operate within an environment where the user has already been authenticated and authorized.

How are roles defined for custom actions?

By default, a custom action uses the roles of the current user. However, if you want to configure a custom action to have expanded privileges, you can specify the roles required for a custom action in the Process Extension Library of Agile Java Client. When you use a custom action in the Agile PLM client, roles that are specified for the custom action, override the privileges of the current user. Once the custom action is completed, the client reverts to the user's original privileges.

How do I configure and deploy a process extension?

Place the JAR file(s) for a process extension in the *agile_home*/integration/sdk/extensions folder on the application server. Included with the JAR file(s) should be a file named com.agile.px.ICustomAutoNumber or com.agile.px.ICustomAction in the META-INF/services directory. The contents of these files are the fully qualified Java class n*ames, one* class per line, for a custom autonumber source or a custom action, respectively.

After I deploy a process extension program on the application server, how do I enable it?

Once process extensions have been deployed, you can configure them for use within Agile PLM clients. In Agile Java Client, you can add custom actions to the Process Extension Library and custom autonumbers to the Autonumbers node table.

After I've deployed JAR file(s) for a custom action or custom autonumber source, do I need to update the application server classpath?

No. The classpath is updated automatically by a special-purpose classloader. The classloader extends the application server classpath with any classes located in *agile_home*/integration/sdk/extensions (or the location specified for the sdk.extensions property in the agile.properties file).

How do you create a custom autonumber source?

Create a Java class that implements the ICustomAutoNumber interface, a server-side API in the com.agile.px package. The code defines the autonumbering logic, for example, prefix, suffix, number of digits, and so on, and the persistence mechanism. The Agile PLM system gets the next number from the custom autonumber source by calling the getAutoNumber() method.

How do you assign custom autonumber sources in Agile Java Client?

In the Classes node, you assign autonumber sources to specific subclasses. In the AutoNumbers node, you can also assign subclasses to an autonumber source.

How do you create a custom action?

Create a Java class that implements the ICustomAction interface, a server-side API in the com.agile.px package. The code defines the custom action, whether to modify the current object, create an external report, integrate the Agile PLM client with an external system, or perform some other business logic. When an Agile PLM client initiates a custom action, the Agile PLM system calls the doAction() method.

How do you associate custom actions with the Tools menu, the Actions menu, Status of a Workflow, and external reports?

In Agile Java Client, open the Process Extensions node to add and configure custom actions. You can associate custom actions with a given Workflow status, the Tools menu and Actions menu for classes. A custom action associated with a Workflow status is initiated automatically when the Workflow assumes that status. A custom action appears on the Tools menu when it is invoked From property and is set to the Tools menu. A custom action appears on the Actions menu for an object when you add it to the Process Extensions tab of the subclass. As indicated earlier in this Guide, external reports can only use URL PXs. As such, a custom action associated with an external report is triggered automatically when that report is executed.

In what order do process extensions appear on the Tools menu or Actions menu of Agile PLM clients?

If you add process extensions to either the Tools menu or an object's Actions menu, they are listed after standard menu commands in the order they were created. You cannot reorder or otherwise manage commands on the Tools menu or Actions menu.

What is the inheritance model of custom actions that are assigned to classes?

Custom actions can be defined at the base class level, the class level, or the subclass level. A custom action defined at the base class level is available to all classes and subclasses beneath the base class. A custom action defined at the subclass level is available only to that subclass.

Where do I put PX and WSX configuration property files?

After deployment changes in Agile PLM Release 9.2.2.2, the agileDomain\config directory is no longer in the classpath. You can put PX and WSX property files in this directory: \oas\j2ee\home\applications\Agile\APP-INF\classes\.

Developing Web Service Extensions

This chapter includes the following:

About Web Service Extensions

Web service extensions (WSX) is a Web service engine enabling communication between Agile PLM and disparate systems both internal and external including Enterprise Resource Planning (ERP) systems, Customer Resource Management (CRM) systems, Business-to-Business Integration systems (B2Bi), other Agile PLM systems, and supply chain partners. WSX can streamline the process for new product introduction (NPI), product changes, and rapid ramp-up of manufacturing resources. It can also simplify the process for aggregating raw product content and making critical product content available in real time to other core systems. WSX contains the tools and framework to develop new Agile PLM Web services.

You can use WSX to:

▫ Make product content available to Enterprise Application Integration (EAI) systems, which can then feed the data to a broad array of internal applications.

▫ Share product content with product design, manufacturing planning, shop floor, Enterprise Resource Planning (ERP), and Customer Relationship Management (CRM) applications.

▫ Make product content available to Business-to-Business (B2B) systems, which can transfer Agile Application server data across corporate boundaries to a wide range of external applications.

▫ Provide content to exchanges, reports, and custom applications and import Product content data from ERP and other supply chain applications.

N o t e   Agile Integration Services (AIS) is a set of Web services that is built with WSX technology to provide programmatic import and export capabilities for the Agile PLM system. AIS is a separately licensed product. For more information about AIS, refer to the *Agile Integration Services Developer Guide.*

Key Features

WSX includes the following key features:

- **Programmatic access to data** – WSX provides programmatic access to data stored in Agile PLM systems and other data resources, allowing you to create custom applications to automate content transfer.

- **Accessibility** – WSX provides accessibility of Agile PLM product content outside the corporate firewall using standard HTTP(S) technology.

- **Multiple programming language support** – WSX supports any language that can create and understand Simple Object Access Protocol (SOAP) and/or Web Services Description Language (WSDL).

- **Multiple output format support** – WSX supports aXML and PDX 1.0. You can also use XSL to transform XML data into any format, or develop Web services that return data in any format.

- **Security** – WSX communicates with XML-compliant applications using Internet-standard communication and security protocols (HTTP and SSL), so the interface is both firewall-friendly and secure.

WSX Architecture

To connect to Agile PLM and the WSX framework, you use standard Web service invocation methodologies.

Figure 8: WSX architecture
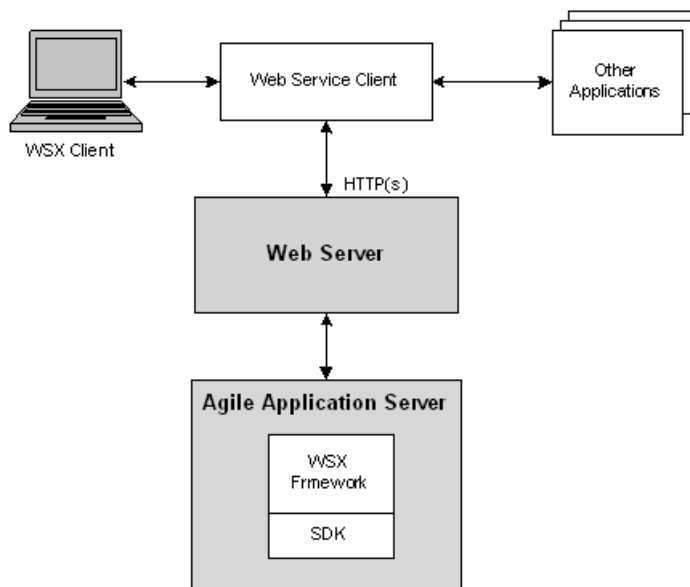
About Web Services

Web services is a technology for building distributed applications. These services, which can be made available over the Internet, use a standardized XML messaging system and are not tied to

any one operating system or programming language. Through Web services, companies can encapsulate existing business processes, publish them as services, search for and subscribe to other services, and exchange information throughout and beyond the enterprise. Web services are based on universally agreed upon specifications for structured data exchange, messaging, discovery of services, interface description, and business process design.

A Web service makes remote procedure calls across the Internet. It uses HTTP(S) or other protocols to transport requests and responses and the Simple Object Access Protocol (SOAP) to communicate request and response information.

The key benefits provided by Web services are:

□ **Service-oriented Architecture** – Unlike packaged products, Web services can be delivered as streams of services that allow access from any platform. Components can be isolated; only the business-level services need be exposed.

□ **Interoperability** – Web services ensure complete interoperability between systems.

□ **Integration** – Web services facilitate flexible integration solutions, particularly if you are connecting applications on different platforms or written in different languages.

□ **Modularity** – Web services offer a modular approach to programming. Each business function in an application can be exposed as a separate Web service. Smaller modules reduce errors and result in more reusable components.

□ **Accessibility** – Business services can be completely decentralized. They can be distributed over the Internet and accessed by a wide variety of communications devices.

□ **Efficiency** – Web services constructed from applications meant for internal use can be used externally without changing code. Incremental development using Web services is relatively simple because Web services are declared and implemented in a human readable format.

Like any technology, Web services have some limitations. When developing Web services, you should consider the following:

□ SOAP is a simple mechanism for handling data and requests over a transport medium. It is not designed to handle advanced operations such as distributed garbage collection, object activation, or call by reference.

□ Because Web services are network-based, they are affected by network traffic. The latency for any Web service invocation can often be measured in hundreds of milliseconds. Thus, the amount of functionality provided by the service should be significant enough to warrant making a high-latency call.

□ Web services are not good at conversational programming. Thus, when designing services to be exposed, you should try to make the service as independent as possible.

Web Services Architecture

You can view Web services architecture in terms of roles and the protocol stack:

□ Web service roles:
  • **Service provider** – This provides the service by implementing it and making it available on the Internet.
  • **Service requestor** – This is the user of the service who accesses the service by opening a network connection and sending an XML request.

- **Service registry** –This is a centralized directory of services where developers can publish new services or find existing ones.

▫ Web services protocol stack:

- **Service transport layer** – uses HTTP to transport messages between applications. Other transports will be supported in future AIS releases.

- **XML messaging layer** – encodes messages in XML format by using SOAP, a platform-independent XML protocol used for exchanging information between computers. It defines an envelope specification for encapsulated data being transferred, the data encoding rules, and Remote Procedure Call (RPC) conventions.

- **Service description layer** –describes the public interface to a specific Web service by using the Web Service Description Language (WSDL) protocol. WSDL defines an XML grammar for describing network services as collections of communication endpoints capable of exchanging messages, which contain either document-oriented or procedure-oriented information. The operations and messages are described abstractly, and then bound to a network protocol and message format. WSDL allows description of endpoints and their messages regardless of what message formats or network protocols are used to communicate. A WSDL document defines services as collections of network endpoints (called ports). A port is defined by associating a network address with a reusable binding, and a collection of ports define a service.

- **Service discovery layer** – centralizes services into a common registry by using the Universal Description, Discovery, and Integration (UDDI) protocol.

Note   WSX does not currently support UDDI or other service discovery layers.

Security

WSX communicates with XML-compliant applications using Internet-standard communication and security protocols (HTTP and SSL). Communication between WSX and its clients (via the Web server) may be encrypted via Secure Sockets Layer (SSL) and a server-side certificate, thus providing authentication, privacy, and message integrity. Using standard Java cryptography libraries, you can encrypt and decrypt files, create security keys, digitally sign a file, and verify a digital signature.

The Web service extensions framework forces any invocation request received from outside the firewall to be secure. In other words, all external requests to WSX must be secured using HTTPS or an equivalent protocol. Internal requests to WSX can be conducted insecurely, that is, using HTTP.

There are several ways to enforce username and password security when invoking a Web service. If you are using the Agile API to develop your Web service, you can specify the username and password in the `createSession()` parameters just as you would with any API program.

For more information about Java security and cryptography support, see
http://docs.oracle.com/javase/1.3/docs/guide/security/index.html.

Tools

There is no single set of tools needed to access Web services. The tools you choose depend very much on the environment you use to develop clients. Basically, you'll need tools that enable you to generate and process XML, and process HTTP request/responses messages.

The WSX framework is based on the Apache eXtensible Interaction System (AXIS), which is a SOAP processor. However, you can use other implementations of SOAP tools, regardless of source language, to build Web service clients.

Note The WSX Java samples included with the Agile SDK show how to use AXIS. For detailed information about AXIS, its features, and how to use it, refer to the AXIS Web site: http://xml.apache.org/axis

Finding Additional Information About Web Services

This is a list of some Web sites to explore:

▫ **WebServices.Org** – http://www.webservices.org/

▫ **Web Services Architect** – http://www.webservicesarchitect.com/

▫ **Web Services Journal** – http://www.informatik.uni-trier.de/~ley/db/journals/jwsr/jwsr8.html

▫ **webservices.xml.com** – http://www.xml.com/pub/a/ws/2001/04/04/webservices/index.html

▫ **Apache Axis** – http://ws.apache.org/axis/

▫ **Java Web Services Developer Pack** – http://www.oracle.com/technetwork/java/javasebusiness/downloads/java-archive-downloads-jwsdp-419428.html

▫ **Sun ONE Web Services Platform Developer Edition** – http://dsc.sun.com/appserver/reference/techart/webservice.html

▫ **Microsoft .Net Framework** – http://msdn.microsoft.com/netframework/

▫ **SOAP::Lite for Perl** – http://www.soaplite.com/

▫ **Soap Tutorial** – http://www.w3schools.com/soap/default.asp

Developing and Deploying a Web Service

Writing your own Web service is a simple task, consisting of a few steps:

1. Define your Web service's entry point(s). A Web service entry point (or operation) corresponds to a public method in a Java class.

2. Code your Web service operation's logic. You need not follow any special rules when coding the logic for your Web service operation. You may take advantage of third party code libraries as well as Agile-provided libraries, including the Agile API.

3. Compile your Java code as you normally would.

4. Copy the compiled JAR file(s) to *AGILE_HOME*\integration\sdk\extensions on the Agile Application Server computer. The deployment descriptor for the Web service should also be in the JAR file(s) in a file named META-INF/services/com.agile.wsx.Deployment.wsdd.

Note If you have several application servers in a clustered environment, you must deploy Web service files on each server in the cluster.

The Agile Application Server automatically deploys all Web services listed in the deployment

descriptor, ensuring that your latest changes have been applied.

About Deployment Descriptors

The Web service deployment descriptor file (Deployment.wsdd) is an XML file that is formatted according to Axis's Web Service Deployment Descriptor (WSDD) format. It declares and describes the set of Web services and Web service operations that are to be exposed via WSX. The WSDD file also defines any additional behavior that should be used when processing incoming SOAP requests (such as authentication, and so on) or responses (such as reformatting outgoing data).

The Axis documentation provides a good introduction to the WSDD format and its use. However, before consulting the Axis documentation, please be aware of the following constraints within WSX:

▫ The Web service deployment descriptor should not contain global WSX configuration information. The configuration information declared within Deployment.wsdd should be restricted to service-specific declarations.

▫ WSX does not support the Axis .jws-based Web services. While these sound good on paper, we have found our mechanism of redeploying Web services to be more robust and easier to work with in a development environment.

▫ For security reasons, WSX does not include the Axis AdminServlet.

For more information about Axis deployment descriptors, refer to the following Axis documentations:

▫ *Axis User's Guide* – http://ws.apache.org/axis/java/user-guide.html

See the sections entitled "Custom Deployment - Introducing WSDD" and "Service Styles - RPC, Document, Wrapped, and Message."

▫ *Axis Reference Guide* – http://ws.apache.org/axis/java/reference.html

See the sections entitled "Deployment (WSDD) Reference."

N o t e   These sites are subject to periodic change. In that event, use your favorite search engine to locate these documents.

Reserved Web Service Names

The following Web service names are reserved because they are used by Agile Integration Services (AIS). Do not use them to name a Web service that you've created.

▫ Export

▫ Importer

▫ Reserved Service names:
  • FSHelper, DmsService (File manager and Viewer)
  • Export, Importer (AIS)
  • ResponseService, PackageService, AcsStatusService (ACS)

Using a Web Service

Once you have developed and deployed your custom Web service, you will want to use it. You can

---

access your Web service using a URL of the form
http://hostname:port#/virtualPath/integration/ws/WebServiceName

Note	You must use the Agile-modified `axis.jar` file that is included with the Agile API. This file
	gets installed in the following location when you install Agile's API component:
	agile_Home\integration\sdk\lib\axis.jar

Defining a Web Service Entry Point

A Web service entry point (or operation) corresponds to a public method in a Java class. Not all public methods in a class need be exposed as an operation, but all operations correspond to public methods. Thus, if you have a Java class (such as `MyClass`), that exposes two public methods (such as `methodOne` and `methodTwo`), it is possible for you to expose either or both methods as Web service operations.

As a general rule, the simpler the datatypes used for your parameter and return types, the more interoperable your Web service operation will be. More complex datatypes will require either custom serializers/deserializers or additional support from the Web service framework. More information on the additional serializers/deserializers provided by Axis can be found at http://ws.apache.org/axis/java/apiDocs/org/apache/axis/encoding/Serializer.html and http://ws.apache.org/axis/java/apiDocs/org/apache/axis/encoding/Deserializer.html. These sites are periodically changed. In this case, invoke your favorite search engine to locate the latest information on these interfaces.

Note	As a rule, do not try to return an Agile API object, such as `IAgileSession` or `IItem`, from a Web service. Web services should only return data structures.

Authenticating Users

All default out-of-box Web services and user customized versions are protected by the application server. To access a protected Web service, add the following lines in your Web service client stub code:

// Configure the stub with the necessary authentication information

stub.setUsername(cl.getOptionValue(USER_SHRT));

stub.setPassword(cl.getOptionValue(PASSWORD_SHRT));

stub.setMaintainSession(true);

To remove the Web container protection for a specific Web service, add the following lines in the following applications:

```
application.ear#application.war/WEB-INF/web.xml
```

and

```
application.ear#integration.war/WEB-INF/web.xml files:
<security-constraint>
   <web-resource-collection>
   <web-resource-name>Unprotect web services</web-resource-name>
```

```
    <url-pattern>/ws/<web service name></url-pattern>
    <url-pattern>/services/<web service name></url-pattern>
    </web-resource-collection>
</security-constraint>
```

Using Single Sign-On Cookies for Client-Server Access

After a user on the WSX client is authenticated by the Agile 9.X server which is protected by third party single sign-on products, the browser is granted a Single sign-on cookie. This cookie is sent to the custom j2ee Web application, provided this application is in the same DNS domain as the Agile 9.X server. Now, to invoke the Web service deployed on Agile 9.X server, you can pass the single sign-on cookie instead of username and password as a valid credential.

N o t e   If you are using both username/password and single sign-on cookies, the single sign-on cookie has precedence over username/password.

Deployment Architecture

Interactions and the request flow between the Agile server and WSX client is summarized in the following illustration.

Equation 1: Deployment Architecture
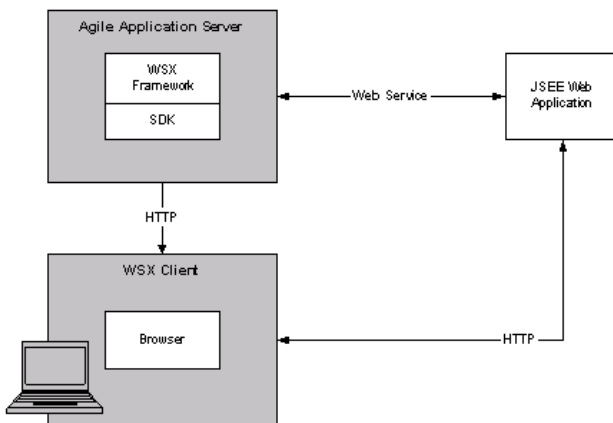
Invoking the Web Service Client with a Single Sign-on Cookie

This is accomplished by first, retrieving the single sign-on cookie from the HTTP request followed by modifying the SOAP binding stub code.

Retrieving the Single Sign-On Cookie

Before invoking the Web service client stub, you must retrieve the single sign-on cookie in the HTTP request. By default, the single sign-on cookie provided by SiteMinder is called "SMSESSION." Modify the cookie to the format specified in RFC2965 available at http://www.ietf.org/rfc/rfc2965.txt. The simplest format is "name=value" where name and value are accessed by calling the `javax.servlet.http.Cookie object` method.

Modifying the SOAP Binding Stub Code

Find the Web service SOAP binding stub class which is generated by wsdl2java utility of axis. It is usually called *service-name.S*oapBindingStub.java. Add a variable named *cookies* and a method to set the value as shown below.

To modify the SOAP binding stub code:

1. Add the following lines in the SOAP stub class:

    ```
    private String cookies = "";

    public void setCookies(String cookies) {

            this.cookies = cookies;

    }
    ```

2. Add the line in bold font in createCall() method.

    ```
    if (super.cachedPortName != null) {

        _call.setPortname(super.cachedPortName);

    }

    _call.setProperty(org.apache.axis.transport.http.HTTPConstants.HEADER_
    COOKIE, this.cookies);

    java.util.Enumeration keys = super.cachedProperties.keys();
    ```

3. Recompile this class and follow the sample below to invoke the Web service stub.

    ```
    ((soaping binding stub class name)stub).setCookies(sso cookies you got
    in step 2);

    stub.setMaintainSession(true);
    ```

4. Compare with the documented sample that requires username and password as valid credentials.

    ```
    stub.setUsername(username);

    stub.setPassword(password);

    stub.setMaintainSession(true);
    ```

5. Test the Web service client as part of the j2ee Web application.

Preparing the Environment for MyFirstWebService

To explain developing a Web service, a sample that highlights the development process is provided. The sample, called MyFirstWebService, is a simple example that demonstrates how to create a Web service that can use the Agile SDK to retrieve information about a particular Item and return the Item as the result of the Web service operation.

To support the desired operation, the following entry point is defined:

```
 public String getItemField(String[] args) throws RemoteException
```

MyFirstWebService sample uses a third party library called Jakarta Commons CLI and parses args as a set of command line arguments. Based on these arguments, the results are returned as

a `String`. You can find more information on implementation details in the SDK_samples.zip folder described in Client-Side Components on page 2. The path to MyFirstWebService is in `samples\wsx\src\first`. The remaining paragraphs in this section describe the deployment process and do not address implementation details.

Downloading Tools to Build the Sample

To build and deploy the `MyFirstWebService` sample, you must download the following tools:

Tool	Download Site
Java 2 SDK SE Version 1.5	http://www.oracle.com/technetwork/java/archive-139210.html
Apache Project's Ant build tool, version 1.6.5	http://archive.apache.org/dist/ant/binaries/

Installing the Java SDK

This section provides the instructions to install the Java SDK on Windows and on Solaris platforms. You can skip this section if you already have the proper version of Java installed.

To install the Java SDK on Windows:

1.   Double-click the distribution and follow the installation procedures.

2.   Set the system variable JAVA_HOME to point to the home directory of your Java SDK installation (for example, D:\j2sdk150).

To install the Java SDK on Solaris:

1.   Execute the distribution (for example, $ ./ j2sdk-1_5_0-solaris-sparc.sh) and follow the installation procedures.

2.   Set the environment variable *JAVA_HOME* to point to the home directory of your Java SDK installation (for example, */home/user/*j2sdk150).

3.   Execute your `.profile` or `.cshrc` (depending on your shell) file to reinitialize your environment settings.

Installing Ant

This section provides the necessary instructions to install Ant on Windows and Solaris environments. Use the information in Downloading Tools to Build the Sample on page 42 to download the Ant tool.

To install the Ant on Windows:

1.   Extract the contents of the Zip archive to a local directory and follow the installation procedures.

     The Ant distribution for Windows is a zip file (for example, apache-ant-1.6.5-bin.zip).

2.   Open a command prompt window and verify that Ant can be invoked by entering the following command:

```
%ANT_HOME%\bin\ant -version
```

The following output is displayed:

```
Apache Ant version 1.6.5 compiled on <date>
```

To install Ant on Solaris:

1. Extract the contents of the tar archive to a local directory (for example, /home/user/ant).

    The ANT distribution for UNIX is a tar file (for example, apache-ant-1.6.2-bin.tar.gz).

2. Execute your `.profile` or `.cshrc` (depending on your shell) file to set up your environment.

3. From a command prompt, verify that Ant can be invoked by entering the following command:

    `$ANT_HOME/bin/ant -version`

    The following output is displayed:

    ```
    Apache Ant version 1.6.5 compiled on compilation_date
    ```

Building MyFirstWebService Sample

Agile provides several sample programs for the SDK, including a sample Web service program called MyFirstWebService. To download the sample program, refer to the **Note** in Client-Side Components on page 2. The MyFirstWebService sample is in the *wsx* folder in SDK Samples.

The Ant tool reads the build.xml script and builds all targets in the following sequence on the server that is running the WSX samples:

1. Compiles the Java code for the Web service into `MyFirstWebService.jar`.

2. Copies the resulting `MyFirstWebService.jar` file, which includes the Deployment.wsdd file, and the
    commons-cli.jar file into the .../sdk/extensions folder.

3. Generates a script (either runner.bat or runner.sh) that can be used to run the client. (It conveniently sets the CLASSPATH needed to run the client.)

4. Generates client-side stub files and places them in the following folder:

    sdk\samples\wsx\built\src\client located in Oracle Agile PLM 9.3 Event and Web Services Samples. To access this folder, see the **Note** in Client-Side Components on page 2.

5. Compiles the client classes and places them in your local server.

To build the WSX sample on the server platform:

1. Copy the SDK_samlpes (ZIP) file. For information to access this file, see the **Note** in Client-Side Components on page 2.

2. Go to samples/WSX folder.

    > **Note**   If there's no `AgileAPI.jar` in this folder, you are not able to compile the WSX sample. In that case, do as follows:

3. Go to $AGILE_HOME/sdk/samples/wsx on the server.

4. Download `wsdl4j-1.5.1.jar` from
    http://archive.apache.org/dist/ws/axis/1_2/ (axis-bin-1_2.zip#/lib), and copy it to lib folder and rename the file to `wsdl4j.jar`.

5. Build the MyFirstWebService sample using the sample's `build.xml` file:

- **On Windows** – `%ANT_HOME%/bin/ant`

- **On Solaris/Linux** – `$ANT_HOME/bin/ant`

Important	If you are not building the Web service sample under $AGILE_HOME/sdk/samples/wsx, then upload the `wsx/built/MyFirstWebService.jar` into $AGILE_HOME/integration/sdk/extensions. This directory is configurable in agile.properties on the server. Because the SDK will not generate WSDL files or WSXs when you invoke `http://hostname:port/virtualPath/services/MyFirstWebService ?wsdl`, it will not return the required WSDL file. To generate these files do as shown in the next step.

6. Copy the package `wsdl4j.jar` file described above into Agile `application.ear#APP-INF/lib` folder and redeploy the ear file.

Note	This step is necessary if you want to access the WSDL file.

7. In the WSX folder, invoke the applicable command below to generate the WSX stub.

Note	This step is necessary if you want to access the WSDL file.

- **On Windows** – `%ANT_HOME%/bin/ant -Dwsx.url=http://webserver/virtualPath/services -Dusername=`*username*` -Dpassword=`*password*

- **On Solaris/Linux** – `$ANT_HOME/bin/ant -Dwsx.url=http://webserver/virtualPath/services -Dusername=`*username*` -Dpassword=`*password*

About Web Service Clients

This section describes the tools that you can use to develop client applications and languages that can generate and process XML files and HTTP request/response messages.

Client Programming Languages

Although Agile tests and certifies Java for use in developing AIS clients, SOAP messages are platform- and language-independent, which means you can use virtually any client programming language that can generate and process XML and process HTTP request/response messages. For example, you can develop clients in Java, Visual Basic.Net, C++, C, or Perl.

There are helpful libraries for Java, .Net, Perl, Python, C++, and C, and for other environments as well. Here are some Web sites where you can find more information:

▫ **Apache Axis** – Open source SOAP implementation for Java: http://ws.apache.org/axis/

▫ **Java Web Services Developer Pack (JWSDP)** – Sun's Java implementation of the SOAP protocol: http://www.oracle.com/technetwork/java/index-jsp-136025.html

▫ **Microsoft .Net** – An XML Web services platform for Microsoft Windows that can be used to create Web service clients: http://msdn.microsoft.com/net

> □ **SOAP::Lite for Perl** – A Perl implementation of the SOAP protocol: http://www.soaplite.com/

Note For a comprehensive list of other SOAP implementations, see the following Web site: http://www.soapware.org/

Accessing a Web Service

In general, to access a Web service, you need to do the following:

1. **Generate a SOAP request** – In many cases, a Web-service-aware code library will be able to generate client-side stubs that generate an appropriately formatted SOAP request.

2. **Submit that request to WSX via HTTP or HTTPS** – Once an appropriate set of client-side stubs has been generated, a client application can use these stubs to submit a request.

3. **Process the SOAP response** – The client-side stubs usually are responsible for processing the SOAP response and converting the response into an appropriate set of return objects.

The WSX samples provide examples of how SOAP and Web service-related libraries can make this process simple. The following sections illustrate, using the MyFirstWebService sample, the above steps in greater detail.

Creating a Web Service Client

When you build and deploy MyFirstWebService, you also automatically generate the client-side stubs and the client classes. This section uses MyFirstClient as an example to describe some general aspects of how to create a Web service client.

Generating the SOAP Request

In most cases, generating an appropriate SOAP request is as simple as making use of client-side stubs. Many Web-service-aware code libraries are able to generate client-side stubs for you. This entails using a code generation utility along with the WSDL for the desired Web service.

Axis provides a WSDL2Java utility that can be used to generate client-side stubs. Other Web-service-aware libraries have their own client-side stub generation facility. Microsoft .Net includes a wsdl.exe utility. In the case of the WSX samples, the client-side stub generation occurs during the samples' build process.

Within the build.xml file, you will find the following Ant target:

```
<target name="generate-stubs" depends="init" unless="stubs.present">
    <fail unless="wsx.url">wsx.url must be defined</fail>
    <axis-wsdl2java output="${built.dir}/src"
    url="${wsx.url}/MyFirstWebService?wsdl">
    <mapping namespace="http://www.agile.com/ws/SampleWsx"
        package="client"/>
    </axis-wsdl2java>
</target>
```

This Ant target is responsible for generating the client-side stubs for MyFirstWebService. This invocation retrieves the MyFirstWebService WSDL from ${ws.url}/MyFirstWebService?wsdl, generates Java code in the client Java package, and places the source code within the

${built.dir}/src directory. For more information on the WSDL2Java utility, please consult the Axis documentation, which can be found on the Axis Web site at http://xml.apache.org/axis.

Once the client-side stubs have been generated, the user can use the generated object definitions in order to more easily generate the appropriate SOAP request. Rather than requiring the user to understand how to construct a valid SOAP request, these stubs allow the user to focus on the capabilities of the target Web service operation. Looking at the MyFirstClient.java sample found within ..\samples\wsx\src\client, note that the main method contains all the code used to generate the SOAP request.

Submitting the SOAP Request

The next step in a Web service operation is to properly submit the generated SOAP request to the Web service engine. When dealing with generated client-side stubs, this step is usually as simple as pointing the stubs to the desired server and invoking a method on the stubs. You do not need to worry about opening a connection. Instead, the generated stubs handle these details for you.

The MyFirstClient.java sample found within ..\samples\wsx\src\client illustrates how to submit the SOAP request in two places:

▫ The `getStub()` method is responsible for pointing the client-side stubs to the desired Web service engine.

▫ The `stub.getItemField()` method invocation found within the main method is responsible for submitting the request to the Web service engine. The submitting of the request is managed by the stubs themselves; you do not need to worry about the connecting, submitting, or marshaling particulars.

The details on how you point the stubs to the desired Web service engine and submit the request vary from code library to code library. Please consult the documentation for your Web-service-aware code library for more information.

Processing the SOAP Response

The processing of the SOAP response is usually handled via the generated client-side stubs. Without these generated stubs, you would be responsible for parsing the XML-based SOAP response and dealing with the many formatting and unmarshaling issues that arise. However, when dealing with generated stubs, all of these details are taken care of for you, allowing you to receive properly typed Java objects. Rather than require you to parse an XML document and discern what the returned data is, the stubs automatically do this for you.

The details on how SOAP responses are processed will vary from code library to code library. Some SOAP servers expect the client to know the datatype through some other means (perhaps WSDL). Please consult the documentation for your Web-service-aware code library for more information.

Running the Sample on the Web Service Client

To build and deploy the MyFirstWebService sample, use the CLASSPATH initializations information in the `runner.sh` (UNIX) or `runner.bat` (Windows) to run sample on the Web service client. You can find these files in the SDK_samples.zip. To access SDK_samples.zip, see the **Note** in Client-Side Components on page 2.

To print out a usage statement for MyFirstClient, enter the following command:

```
> runner client.MyFirstClient
```

The following usage statement returns the "Title Block.Description" field for part 1000-02:

```
> runner client.MyFirstClient -T 15000 -a "attribute_name"
    -e virtual_path -h host -l port_no. -n item_number -p password -u
    username
> runner client.MyFirstClient -T 15000 -a "Title Block.Description"
    -e Agile -h localhost -l 80 -n 1000-02 -p agile -u jeffp
```

Creating an Agile Session inside WSX

By default, the Web container protects the WSX. Therefore, you must specify user credentials when creating an Agile Session inside the WSX. The following example creates an Agile session within a protected WSX.

Example: Setting up a session inside a WSX

```
AgileSessionFactory factory = AgileSessionFactory.getInstance(null);
IAgileSession session = factory.createSession(null);
```

Note   Do not override the implicit session.

To have a different user, you need to make an explicit SDK session as if connecting from a remote client. That is, provide an argument to the AgileSessionFactory.getInstance() method.

Example: Creating an explicit session independent of the implicit session

```
AgileSessionFactory factory = AgileSessionFactory.getInstance
("http://...");
HashMap params = new HashMap();
    params.put(AgileSessionFactory.USERNAME, ...);
    params.put(AgileSessionFactory.PASSWORD, ...);
    IAgileSession session = factory.createSession(params);
```

Microsoft .NET Interoperability

Microsoft's .NET framework technology is a development framework that provides an application programming interface (API) to the services and APIs of classic Windows operating systems, while bringing together a number of disparate technologies that emerged from Microsoft in the late 1990s: ASP, COM+, XML, SOAP, to name a few.

.NET also brings together all the languages provided by the Visual Studio environments provided by Microsoft such as Visual Basic, J++, and C++. Also, new languages have been developed - such as C# (read C Sharp) and the relatively new language to the .NET family, J# (read J Sharp). J# is actually Java in Microsoft disguise providing integration of Java into the .NET framework. Yet, J# will not work with the Java VM. J#, in essence, acts as a wrapper to contain Java-enabled code to be executed by the .NET Common Language Runtime (CLR), Microsoft's own 'virtual machine'.

The CLR is probably the most important component to the .NET framework. The CLR provides for the activation of objects, security checks, memory management, object execution, and memory cleanup (garbage-collection) when objects are no longer being used.

Another factor behind .NET is that it not only provides for the writing of Windows-based applications or Web-based applications (via ASP.NET) by using any of the languages mentioned, it also can integrate these languages into one common API. This means that developers can write language independent code, inherit from classes, catch exceptions, and take full advantage of polymorphism

---

across differing languages across the .NET framework.

> **Important** Although the WSX framework (the AXIS SOAP processor) works fine with AXIS Web service clients, it is not completely compatible with .Net. Neither Microsoft nor the Apache group have conducted interoperability tests for AXIS and .Net. For simple data types, AXIS-based Web services should work fine with .Net-based Web service clients. For some complex data types (such as binary attachments), you may experience interoperability problems. For interoperability information about non-AXIS Web service implementations deployed outside of the Agile Application Server, contact the specific Web service vendor.

Web Service Extensions FAQs

This section answers common questions about Web service extensions.

What is Web service extensions (WSX)?

WSX is a framework for Agile customers to extend the functionality of the Agile PLM server using Web services.

What are Web services?

Web services use the SOAP messaging protocol to provide software services over the Internet, allowing software components to interact with each other around the world. Web services are not tied to any one operating system or programming language. They use WSDL to describe a service's public interface, essentially making Web services self-describing and therefore relatively easy to use.

What can I do with WSX that I can not do solely with Agile's Java API?

WSX provides firewall-friendly, XML-based integration with Agile PLM data using the standard HTTP(S) protocol. It supports any SOAP-compliant programming language. For example, you can create Perl or .Net clients for a Web service. WSX enables systems in different companies to interact with each other easily and securely. Services deployed within WSX take advantage of all the scalability, failover, and clustering features provided by the application server. There are also compelling performance benefits to services that run on the application server.

Does WSX support both secured and unsecured connections?

Yes. Requests that come to a Web service from outside the firewall are subject to different security requirements from requests that originate within the firewall. Two separate entry points are provided for each WSX, external (outside the firewall) or internal. External requests are made against a proxy server and then forwarded to the application server. The proxy server resides in the DMZ. Internal requests can be made against the same secure proxy server, another proxy server that doesn't reside in the DMZ, or directly against the application server, as shown in the following figure.

Figure 9: How Web service clients connect to the Agile PLM server
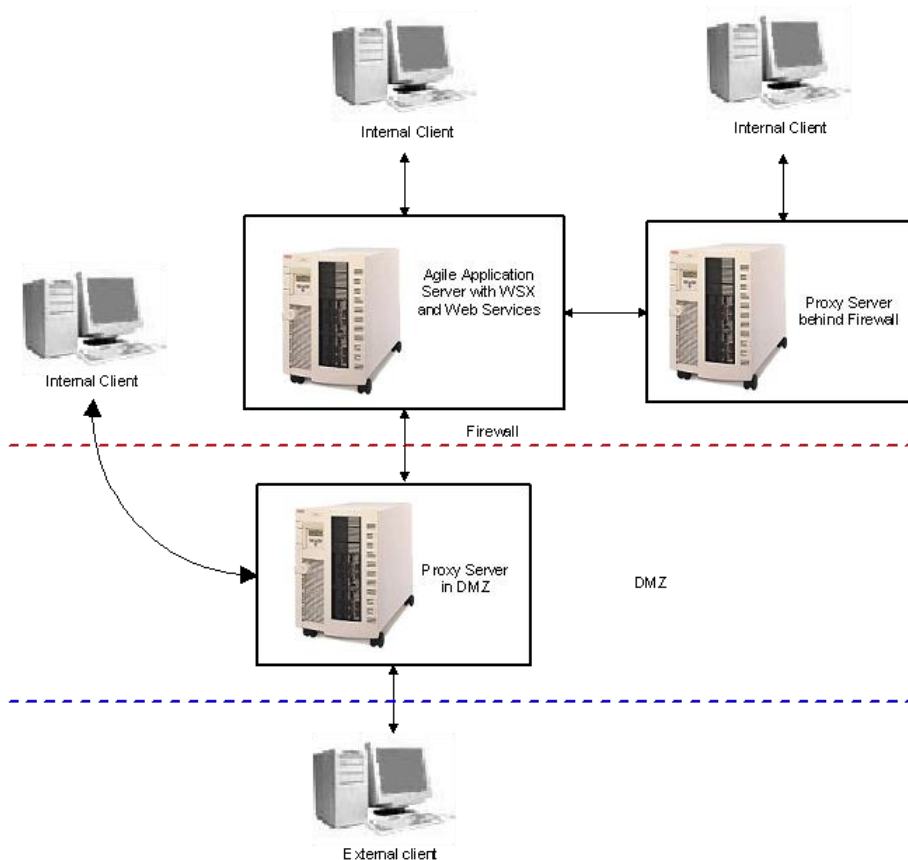
What user authentication services are provided by WSX?

By default, WSX is protected by the application server. Username and password security is enforced whenever a WSX client invokes a service that is protected. For more information, see Authenticating Users (on page 39).

What SOAP engine does WSX use?

WSX is based on Apache Axis, an open-source implementation of SOAP. For more information about Axis, refer to the Axis Web site at http://ws.apache.org/axis/.

Does WSX handle SOAP attachments?

Yes. In fact, Agile Integration Services provides exportData and importData services that let you export and import binary attachment files.

Does WSX support stateful sessions?

Yes. The Axis Web services engine at the heart of WSX maintains session state between connections. Sessions can be based on HTTP cookies or on SOAP headers. This is useful for generating server-side code that supports more persistent applications instead of simple, one-shot processes. For more information about Web services sessions, refer to Axis documentation. You can start with the Axis FAQ located at http://ws.apache.org/axis/faq.html.

Does WSX support protocols other than HTTP?

No. WSX supports only HTTP-related protocols. For additional security, you can connect to a Web service using HTTPS and SSL. Over time, WSX may support additional protocols as needed.

Does WSX support Perl, Python, PHP, or other Web scripting languages?

WSX supports any client programming language that can send a SOAP message. Although the Agile SDK does not provide WSX client examples in Perl, Python, or PHP, those scripting languages are certainly capable of sending SOAP messages.

Does WSX support UDDI?

No. UDDI is a specification for a universal business registry of Web services that's designed to enable software to automatically discover and integrate with other services. It's currently unnecessary to register Agile PLM Web services on the Internet using UDDI. Agile PLM Web services are typically created for integration with internal software systems or to exchange data with partners or suppliers. However, Agile may consider supporting UDDI as the technology matures.

How do I deploy a Web service?

Place the service's JAR files in the *agile_home*/integration/sdk/extensions folder on the application server computer. Included with the Web service's JAR file(s) s*hould be a* deployment descriptor file named META-INF/services/com.agile.wsx.Deployment.wsdd.

The deployment descriptor file is an XML file formatted according to Axis' Web Service Deployment Descriptor (WSDD) format. It declares and describes the set of Web services and Web service operations that are exposed via WSX. The WSDD file also defines any additional behavior that should be used when processing incoming SOAP requests (such as user authentication) or responses (such as reformatting outgoing data). For more information about WSDD format, refer to the *Axis Reference Guide* at http://ws.apache.org/axis/.

When I deploy a Web service and its JAR file(s), do I need to update the application server classpath?

No. The classpath is updated automatically by a special-purpose classloader. The classloader extends the application server classpath with any classes located in *agile_home*/integration/sdk/extensions (or the location specified for the sdk.extensions property in the agile.properties file).

If I make changes to a Web service and redeploy it, do I need to restart the application server?

No. A special-purpose handler ensures that the Web services stack is updated with the latest files that have been deployed. Whenever a Web service request is made, the handler checks whether any JAR files located in *agile_home*/integration/sdk/services is updated, added, or removed. If so, the entire Web services stack is reset. This feature allows you to recompile your code and redeploy a Web service without having to restart the application server, saving you precious development time.

Are there any Agile products that use the WSX framework?

Yes. Agile Content Service (ACS) and Agile Integration Services (AIS) both rely on WSX framework to exchange data with the Agile PLM server.

What are Agile Integration Services?

Agile Integration Services (AIS) are Web services that provide import, export, and partlist functionality. Included with these Web services are sample Java Clients, but you can create other SOAP-compliant AIS clients in other programming languages.

What is basic authentication?

Basic authentication is a simple method of authentication. It allows a client program to provide credentials in the form of an unencrypted user name and password when making a request. There is a new Web module that uses basic authentication for deploying Web service listeners. You can find information to access Web services with basic authentication at: http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/index.jsp?topic=%2Fcom.ibm.websphere.express.doc%2Finfo%2Fexp%2Fae%2Ftwbs_auwschta.html

For example, use this URL for the MyFirstWebService sample:

http://hostname/Agile/integration/ws/MyFirstWebService?wsdl

Developing Dashboard Management Extensions

This chapter includes the following:

About Dashboard Management Extensions

Similar to Process Extensions, Dashboard Management Extensions (DX) extend the functionality of the Agile PLM system. The Extensions support the following formats to access and display PLM data on the Agile PLM Dashboard:

- ChartDataModel for charts

- Collections for tables

When data is defined using these formats, Agile servers can interpret and process this data, and Agile Java Client users with administrator privileges can define Dashboard Tabs and display them in one of the following views or layouts:

- Chart

- Table

- Custom (URL)

The SDK provides the API's that enable connecting the Agile PLM server to internal Agile databases to get the required content, format it as required by the DXs, and display the data in the Agile PLM Dashboard. Similarly, you can use other Java API's such as JDBC to connect to external databases for content.

Briefly, DXs provide the data, Dashboard Tabs and the formats to display the data (tables, charts, and URLs) are configured in Agile Java Client. Finally, Agile PLM users with proper privileges can view the Dashboard Tab and displays in Agile Web Client.

This chapter provides both background information and procedures to develop these methods.

Roles and Privileges in Dashboard Management Extensions

You must set the Dashboard Tab View privilege in **Admin**>**User Settings**>**Privileges** so that PLM users can view the Tabs and the related data in Web Client. In addition, Dashboard Tabs are controlled by privileges, and Agile PLM users must have the necessary roles and privileges to view the data on the Tab. Procedures to configure the views and assign privileges are fully documented in *Agile PLM Administrator Guide*.

Developing Custom Chart Dashboard Management Extensions

The `ICustomChart` interface enables creating the necessary DXs that will display the required data in chart formats. This interface exposes the method which returns an instance of the public `ChartDataModel getChart(IAgileSession session, Map params)`

Note   Implementations of this interface must have no-arg constructors and they must be reentrant.

Understanding ChartDataModel and ChartDataSet

The `ChartDataModel` class organizes the input data in a chart format. It is a concrete class that is exposed to the DXs and It contains one or more `ChartDataSet(s)` that you need to construct the chart.

A `ChartDataSet` is another concrete class that is exposed to the DXs. It contains the data required to plot a chart. For example, X-axis and Y-axis values and labels. The `ChartDataModel` is a placeholder for all the data sets.

Note   The `ChartDataModel` and `ChartDataSet` classes are exposed in `com.agile.px` package.

Defining a Custom Chart DX Data Source

As indicated above, chart DXs display the data in chart formats. The code in the Example:Defining a DX to display data in a chart format, uses `ICustomChart` and the exposed classes (`ChartDataModel` and `ChartDataSet`) to display the differences between morning and evening temperatures for every day of the week, using predefined input data in a chart format.

Example: Defining a DX to display data in a chart format

```
package dashboard.chart;

import java.util.Map;
import com.agile.api.IAgileSession;
import com.agile.px.ICustomChart;
import com.agile.px.ChartDataModel;
import com.agile.px.ChartDataSet;

/**
    * A Sample Dashboard DX for Charts with predefined data.
    * This Example displays a comparison chart between
    * Morning and Evening Temperatures for each day of the
    * week with predefined data.
*/
```

```
public class TemperatureComparisionChart implements ICustomChart(

/**
    * Returns custom ChartDataModel. ChartDataModel
    * is a placeholder to hold all the
    * ChartDataSet(s) and any other relevant information related to the
    charts.
    * @param session current user session.
    * @param params
    * @return com.agile.px.ChartDataModel
 */
public ChartDataModel getChart(IAgileSession session,Map params) throws
Exception{
// Create a ChartDataModel
    ChartDataModel chartDataModel = new ChartDataModel("Temperatures");
// Create a ChartDataSet for Morning and Evening Temperatures
    ChartDataSet chartdataSet[] = new ChartDataSet[2];
// Create a ChartDataSet for Morning Temperatures
    chartdataSet[0] = new ChartDataSet("Morning Temperatures",7);
// Fill in the Morning Temperatures
    double[] morTempValues = {10, 8, 12, 19, 10, 14, 13};
    chartdataSet[0].setValues(morTempValues); // or setYValues that can
    be used instead
// Set the Labels
    String[] labels =
        {"Monday", "Tuesday", "Wednesday", "Thursday", "Friday",
        "Saturday", "Sunday"};
    chartdataSet[0].setLabels(labels);
// Create a ChartDataSet for Evening Temperatures
    chartdataSet[1] =
        new ChartDataSet("Evening Temperatures",7);
// Fill in the Evening Temperatures
    double[] eveTempValues = {16, 12, 20, 15, 18, 24, 26};
    chartdataSet[1].setValues(eveTempValues);
    chartdataSet[1].setLabels(labels);


// Set the ChartDataSets in the Chart Model
    chartDataModel.setDataSets(chartdataSet);
return chartDataModel;
}
}
```

Packaging and Deploying a Custom Chart DX Source

After developing the necessary classes for a new Chart, package and deploy them using the following procedure.

To package and deploy a Chart DX source:

1. Use your Java development environment or the Java Archive tool (or JAR tool), to create one or more JAR files for the custom action. Make sure the JAR file(s) includes a META-INF/services directory that contains the file com.agile.px.ICustomChart. This is a text file that lists the fully qualified Java class names, one class per line, for the custom action.

    You can include multiple charts in one package. For example, `com.agile.px.ICustomChart` could look like this:

    `dashboard.chart.TemperatureComparisionChart`

    `dashboard.chart.AgileObjectsCountChart`

    `dashboard.chart.ActualVsBudgetedLaborCostChart`

    > **Note** Paths within a JAR file are case-sensitive. Therefore, make sure the META-INF folder contained within the JAR file name are either all uppercase or all lowercase characters. Otherwise, the custom action will fail to deploy.

2. Place the JAR file(s) in the *agile_home*/integration/sdk/extensions folder on the same computer where the Agile Application Server is installed.

    > **Note** If you have several application servers in a clustered environment, you must deploy the Dashboard Extension files on each server in the cluster.

Configuring Chart DXs in Java Client

In Agile Java Client, you can define Chart data sources in the Admin module. To configure the Agile PLM system settings, you must have an administrator account. This is briefly documented in the sequel below. For more information, refer to the *Agile PLM Administrator Guide*.

The data that you provide for a DX, regardless of the layout, is viewed in a Dashboard Management Tab. Because you cannot define a new Table in the Out of Box Tabs such as Executive or Financial, you must define a new Tab and then a Table within the Tab to configure a DX.

To add an optional Dashboard Management tab:

1. In Java Client, select **Admin** > **Systems Settings** > **Dashboard Management** and click the **New Dashboard Tab** icon in Dashboard Management.

2. In the Create Dashboard Tab dialog, complete the name (For example, call it **Dashboard Extensions**) and description fields, set the **Visible** field to **Yes**, and then click **OK**. Dashboard Extensions appears as an entry in the Dashboard Management.

3. Click the **Order Tabs for Dashboard** icon to reorder the tabs as required in Java Client.

Displaying Optional Tabs in Agile Web Client

You can display the new optional Tab in Agile Web Client and users satisfying the privileges requirement can view the tabs and the corresponding data. You can find the necessary procedures in *Agile PLM Administrator Guide*.

To configure a Chart type table in the optional tab:

1. Define a new tab, for example, Dashboard Extensions as shown above.

2. In the new tab (Dashboard Extensions), click `Tables` The Dashboard Management - Dashboard Extensions page appears.

3. In this page, click the **New Dashboard Table** icon to open the Create Dashboard Table dialog and define the new table.

4. Select **Chart from the** View List Type drop-down list. The following fields appear.

Dashboard Table	Description/Purpose	Possible Settings
Name	Type the name of the table	String
API Name	The Name typed above, converted to *CamelCase* naming convention by Agile PLM	String
Description	Type the description of the table	String (optional)
View List Type	Lists the types of table. Select **Chart** (when you select Chart, additional options are displayed).	Chart, Table, Custom, Advance Search
Dashboard Extension	Lists all process extensions created for chart type list. Select the chart process extension you want.	
Visible	To enable viewing in Web Client	Yes/No
Chart Type	Select the type of chart you want displayed	Area, Bar, Line, Pie, Polar, Scatter, Stacked Area, Stacked Bar, Table
X axis	Type the X axis label	(optional)
Y axis	Type the Y axis label	(optional)
Show Legend	To display the chart legend on screen	Yes/ No
Legend Position	Select the position where the Legend should be displayed	Bottom, default, left, right, top
3D Style	To view the graph in 3D	Yes/ No
Header	Enter a header note if required	(optional)
Footer	Enter a footer note if required	(optional)

5. Complete the fields and then click **OK**. The name of the new Chart appears in the Dashboard Management - Dashboard Extensions view.

Developing Custom Table Dashboard Management Extensions

The `ICustomTable` interface is defined to create DXs to display the required data in tabular formats. This interface exposes the `getTable(IAgileSession session, Map params)` method which returns an instance of the Collection class.

```
public Collection getTable(IAgileSession session, Map params);
```

Note   Implementations of this interface must have a no-arg constructor and they must be reentrant.

Understanding Collections and CustomTableConstants

The Tabular Data in a DX is a "collection" of Java HashMaps. Each Map key represents an attribute in the Table View and the Map represents a row in the table.

The property "Attribute" of a column in View defines the mapping between the data model and the Table View. The value of this property corresponds to the key of a HashMap entry.

▫ **HashMap keys** – For HashMap entries, an attribute is defined in the Table view. For example, a HashMap entry with "name" as its key value, the property "Attribute" of this attribute will have the value "name." The `get('name')` method will provide the display data for this attribute.

▫ **Link, Image, Money, Text, Date and Numeric Data** – These data types are supported in Tabular DX formats and return objects with the following properties.

  • **Text** – Date, and Numeric Data types do not require any additional properties.

  • **Link** – A valid URL (as String) serves as the target and label for the display. The properties expected for a link data type are the same for the internal and external links. The DX users resolve the URL for internal links and add them to the URL property. The DX users can specify the target property as "RightPane" for internal links. By default, the links will be targeted to a new window.

  • **Image** – Images are expected to return an image URL (as String) and label to be displayed as a tool tip on the Image.

  • **Money** – Currency code (String) and Value (Number) needs to be provided for Money Data types

Note   Keys that support the Link, Money and Image data properties are provided as constants in the class CustomTableConstants. A constant SERVER_URL is provided in this class. You can use it get the Server URL in the DX's from the params.

Defining a Custom Table DX Data Source

The sample Dashboard DX in the following example creates a collection of rows with predefined data for display in the Dashboard. Each row is a Java Map object with key-value pairs that correspond to each column in the table. This value appears in each cell of the column in the table. The key is the mapping Attribute name in the View. When creating new Attributes (columns) in the View, it is necessary to supply this key in the Attribute field. Attribute Names and the corresponding

Data type for this DX are as follows:

Attribute	Corresponding Data Type
myString	Text
myExternalLink	Link
myDate	Date
myMoney	Money
myNumber	Numeric
myImage	Image

Example: Defining a Dashboard extension to display data in tabular format

```
package dashboard.table;
import java.util.*;
import com.agile.api.IAgileSession;
import com.agile.px.ICustomTable;
import com.agile.px.CustomTableConstants;


/** This Sample Dashboard DX creates a collection
 * of rows with predefined data
 * in the format to be displayed in the Dashboard.
 * Each row is a Java Map object which has
 * key-value pairs corresponding to each column in the Table.
 * The value is displayed in each Cell of the
 * column in the table. The key is the
 * mapping Attribute name in the View.
 * While creating new Attributes (Columns) in the View,
 * you must supply this key in the Attribute field.
 * The corresponding Attribute Names and
 * Data type for this DX are listed below.
 *   <table border="1">
 *   <tr><td><b>Attribute</b> </td><td><b>Data    Tye<b></td></tr>
 *   <tr><td>myString         </td><td>Text       </td></tr>
 *   <tr><td>myExternalLink   </td><td>Link       </td></tr>
 *   <tr><td>myDate           </td><td>Date       </td></tr>
 *   <tr><td>myMoney          </td><td>Money      </td></tr>
 *   <tr><td>myNumber         </td><td>Numeric    </td></tr>
 *   <tr><td>myImage          </td><td>Image      </td></tr>
 *   </table>
 *
```

```java
*/

public class DashboardSampleTable  implements ICustomTable {
 /**
* Returns custom table data in form of collection of rows.
* Row is assumed to be a java Map object.
* @param session the user session
* @param params
* @return : java.util.Collection
 */
public Collection getTable (IAgileSession session,Map params) throws
Exception{
String serverUrl =
    (String)params.get(CustomTableConstants.SERVER_URL);
String baseUrl =
    serverUrl.substring(0,serverUrl.lastIndexOf('/'));
    ArrayList result = new ArrayList();
// 1st Row Entry
    HashMap row1 = new HashMap();
// For Text type
    row1.put("myString","Manoj Yeturu");
// For Numeric type
row1.put("myNumber",new Double(10000));


// For Date Type
row1.put("myDate",new Date());


// For Image Type. The url for image and label (for tooltip) properties
are set
    HashMap hm1Image = new HashMap();
    hm1Image.put(CustomTableConstants.URL,baseUrl+"/images/action_noshad
    .gif");
// Tool Tip
    hm1Image.put(CustomTableConstants.LABEL,"Action_Noshad");
    row1.put("myImage",hm1Image);
// For Money Type. The Currency and value properties are set
    HashMap hm1Money = new HashMap();
    hm1Money.put(CustomTableConstants.MONEY_CURRENCY_CODE,"USD");
    hm1Money.put(CustomTableConstants.MONEY_VALUE,new Integer(3000));
    row1.put("myMoney",hm1Money);
// For External Link, url, label (display string) and target
(Rightpane,_new etc) are set
    HashMap externalLink1 = new HashMap();
    externalLink1.put(CustomTableConstants.URL,"http://www.agile.com");
    externalLink1.put(CustomTableConstants.LABEL,"Agile");
    externalLink1.put(CustomTableConstants.TARGET,"_new");
```

```
       row1.put("myExternalLink",externalLink1);
       result.add(row1);


// 2nd Row Entry
       HashMap row2 = new HashMap();
// For Text type
       row2.put("myString","Venkat Tipparam");
// For Numeric type
       row2.put("myNumber",new Double(50000));
// For Date Type
       row2.put("myDate",(new Date()));
// For Image Type
       HashMap hm2Image = new HashMap();
       hm2Image.put(CustomTableConstants.URL,baseUrl +
       "/images/addressdown.gif");
// Tool Tip
       hm2Image.put(CustomTableConstants.LABEL,"Addressdown");
       row2.put("myImage",hm2Image);
// For Money Type
       HashMap hm2Money = new HashMap();
       hm2Money.put(CustomTableConstants.MONEY_CURRENCY_CODE,"INR");
       hm2Money.put(CustomTableConstants.MONEY_VALUE,new Integer(4000));
       row2.put("myMoney",hm2Money);
// For External Link
       HashMap externalLink2 = new HashMap();
       externalLink2.put(CustomTableConstants.URL,"http://www.agile.com/ser
       vices/support.asp");
       externalLink2.put(CustomTableConstants.LABEL,"Supprt");
       externalLink2.put(CustomTableConstants.TARGET,"_new");
       row2.put("myExternalLink",externalLink2);
       result.add(row2);
       return result;
       }

}
```

Configuring the Link Data Type for Objects Created in Custom Table DXs

In Understanding Collection and CustomTableConstants on page 58 , the Link data type is defined
as follows:

□   A valid URL string that serves as the target and label for the display

And

□   DX users can specify the target property as "RightPane" for internal links which are targeted to
    a new window by default

When Web Client users retrieve an Agile Object in a Dashboard table by invoking Advanced

Search, they automatically get the Number with a Link and Quick View as shown in the following illustration.

Figure 10: The Quick View option in a Dashboard
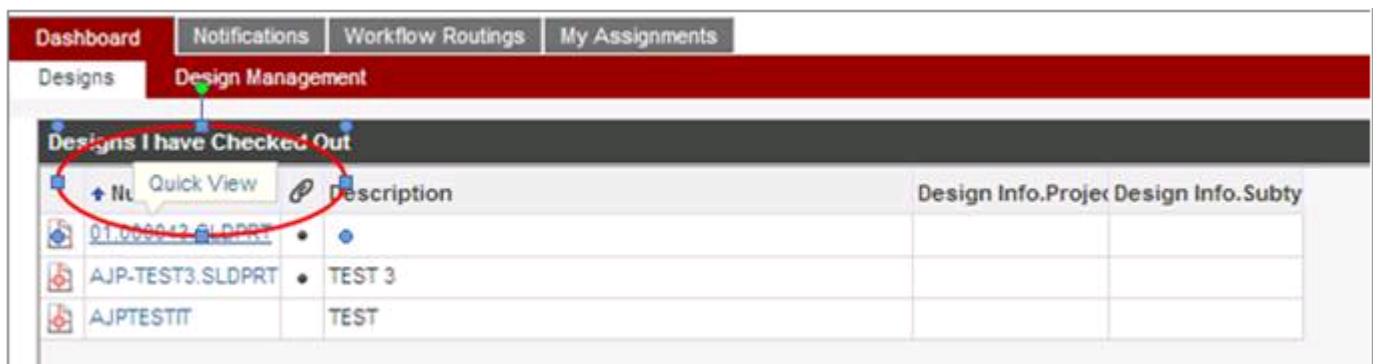
The SDK supports configuring the URL in the Link data type to display Quick View and open the selected object in the RightPane for Agile Objects that are generated through user-defined Dashboard table DXs with `ICustomeTable`. To perform these configurations, you must first invoke the Advanced Search function to retrieve the Object.

Invoking Advanced Search in a Custom Table DX Data Source

The following code snippet returns the specified Agile Object and enables the Quick View pop-up for that Object.

Example: Invoking Advanced Search in a Custom Table DX Data Source

```
public class DashboardTableContainsQuickView implements ICustomTable{
    public Collection getTable(IAgileSession session, Map params)
        {
            try
            {
                IQuery query = null;
                query = (IQuery)session.createObject(-5,
                ProgramConstants.CLASS_ACTIVITIES_CLASS);
                query.setCaseSensitive(false);
                query.setCriteria("[General Info.Name] contains
                'Dashboard'");
                Iterator iter = query.execute().iterator();
                ArrayList result = new ArrayList();
                while (iter.hasNext())
```

```
            {
            IRow row = (IRow)iter.next();
            HashMap rowMap = new HashMap();
            IProgram program = (IProgram)row.getReferent();

            program.getId();
            String number = program.getName();
            rowMap.put("number", number);

            String name =
            (String)program.getCell(ProgramConstants.ATT_GENERAL_INFO_
            NAME).getValue();
            HashMap internalLinkMap = new HashMap();
            internalLinkMap.put("label", name);
            internalLinkMap.put("target", "RightPane");
            rowMap.put("name", internalLinkMap);
            result.add(rowMap);

            }
            return result;

        }
        catch (Exception e)
        {
            e.printStackTrace();
        }return null;
        }
 }
```

Enabling Quick View in a Custom Table DX Data Source

The following example enables Quick View for the Object returned by the search function. Code in the shaded area enables Quick View. To display Quick View you must specify the correct Object Class ID (getClassId()) and Object ID (getObjectId) attributes. In this example, ActivityHandler is hard coded, because this is the object type that the user wants to open. For other types of object, for example, Part, you can use itemhandler. The output of this DX is displayed in <u>Sample output generated by the DX</u> on page 65.

Example: Enabling Quick View in a Custom Table DX Data Source

```
public class DashboardTableContainsQuickView implements ICustomTable{
    public Collection getTable(IAgileSession session, Map params)
        {
            try
            {
                IQuery query = null;
                query = (IQuery)session.createObject(-5,
                ProgramConstants.CLASS_ACTIVITIES_CLASS);
                query.setCaseSensitive(false);
                query.setCriteria("[General Info.Name] contains
                'Dashboard'");
                Iterator iter = query.execute().iterator();
                ArrayList result = new ArrayList();
                while (iter.hasNext())
```

```
            {
                IRow row = (IRow)iter.next();
                HashMap rowMap = new HashMap();
                IProgram program = (IProgram)row.getReferent();

                program.getId();
                String number = program.getName();
                rowMap.put("number", number);


                String name =
                (String)program.getCell(ProgramConstants.ATT_GENERAL_IN
                FO_NAME).getValue();
                HashMap internalLinkMap = new HashMap();
                // Generate Quick View - Object ID and Class ID are necessary
                    int objClsId = ((Integer)row.getClassId()).intValue();
                    int objId = ((Integer)program.getObjectId()).intValue();
                    int objVersion =
                    ((Integer)program.getObjectVersion()).intValue();
                    String urlStr =
                        "javascript:displayObject('ActivityHandler',
                        '" + objClsId + "', '" + objId + "', '0');
                        \"onmouseover=\"showQuickViewLink(event, this)\"
                        onmouseout=\"cancelQuickViewTimer(this);
                        \" infourl=\"showObjectInfo('" + objClsId + "',
                        '" + objId + "', '', '', '', 'true', '',
                        '"+ objVersion +"');\"\");";
                        internalLinkMap.put("url", urlStr);

                internalLinkMap.put("label", name);
                internalLinkMap.put("target", "RightPane");
                rowMap.put("name", internalLinkMap);
                result.add(rowMap);

            }
            return result;


        }
        catch (Exception e)
        {
            e.printStackTrace();
        }return null;
    }
}
```

Figure 11: Sample output generated by the DX

Displaying Quick View with Mouseover

To display Quick View when moving the mouse over the Object ID, set the URL parameter as shown in the following code snippet. Make sure you are using correct values for `classid` and `objectid` parameters.

Example: URL parameter settings to display Quick View

```
HashMap internalLinkMap = new HashMap();
    internalLinkMap.put("url",
    "javascript:displayDesignObject('AttachmentHandler', '2000008297',
        '21335435', '0', 'RightPane', '0', '', '4');"
        onmouseover="showQuickViewLink(event, this)"
        onmouseout="cancelQuickViewTimer(this);"
        infourl="showObjectInfo('2000008297', '21335435', '1', '6173',
        'R0', 'true', 'DASHBOARD_DXTABLE_2488764_GRID', '4');"");
    internalLinkMap.put("label", name);
    internalLinkMap.put("target", "RightPane");
    rowMap.put("name", internalLinkMap);
```

| **Note** | In this example, 2000008297 is the object's `classId`, 21335435 is the object's `ID`, and so on. These values were defined in the code snippet in Enabling Quick View in a Custom Table DX Data Source on page 65. |

Opening the Selected Object in the Right Pane

By default, when you use the Link option to open the selected object, the object is displayed in a new Window. The following syntax opens the referenced object in the right pane of the same window for an object retrieved using Advanced Search shown above.

| **Note** | You must specify the correct Class ID and object ID attributes. In this case,18022 and 4555 respectively. Also, this link does not enable Quick View. It is a quick way to put a link in your code. The Quick View option creates a link that enables the Quick View popup. |

Example: Opening the selected object in the right pane

```
String name =
(String)program.getCell(ProgramConstants.ATT_GENERAL_INFO_NAME)get.V
alue();
HashMap internalLinkMap = newHashMap();
    internalLinkMap.put("url","/web/PCMServlet?module=ActivityHandler
    &opcode=displayObject&classid=18022&objid=4555");
    internalLinkMap.put("label",name);
```

```
internalLinkMap.put("target","RightPane");
rowMap.put("name",internalLinkMap);
```

Packaging and Deploying a Custom Table DX Source

After developing the required classes for a new Table, package and deploy them as shown below.

To package and deploy a Table DX source:

1. Use your Java development environment, or the Java Archive tool (or JAR tool), to create one or more JAR files for the custom action. Make sure the JAR file(s) includes a META-INF/services directory that contains a file named `com.agile.px.ICustomTable`. This is a text file that lists the fully qualified Java class names, one class per line, for the custom action.

   You can include multiple charts in one package. For example, the `com.agile.px.ICustomTable` file could look like this:

   `dashboard.chart.ActualVsBudgetedLaborCostTable`

   `dashboard.chart.DashboardSampleTable`

   `dashboard.chart.QueryDashboardPrograms`

   > **Note**   Paths within a JAR file are case-sensitive. Therefore, make sure the META-INF folder contained within the JAR file has a name with all uppercase or all lowercase characters. Otherwise, the custom action is not deployed.

2. Place the JAR file(s) in the <agile_home>/integration/sdk/extensions folder on the same computer where the Agile Application Server is installed.

   > **Note**   If you have several application servers in a clustered environment, you must deploy the Dashboard Extension files on each server in the cluster.

Configuring Table DXs in Java Client

Similar to Chart type DXs, you can use an existing Dashboard Management tab, or create your own optional tab to add your Table DXs.

To Add a Table to a Tab:

1. Define a new tab. For example, Dashboard Extensions as shown above.

2. In the new tab (Dashboard Extensions), click Tables. The Dashboard Management - Dashboard Extensions page appears.

3. In this page, click the **New Dashboard Table** icon to open the Create Dashboard Table dialog and define the new table.

4. Select **Table** from the **View List Type** drop-down list. The Create Dashboard Table dialog displaying the necessary fields appears.

5. Complete these fields and then click **OK**. The new table is created.

Dashboard Table	Description/Purpose	Possible Settings
Name	Type a name for the table	String
API Name	The Name field typed above, converted to *CamelCase* naming convention by AgilePLM	String
Description	Type a description of the table	String
View List Type	Lists the types of table. Select **Table**	Chart, Table, Custom, Advance Search
Dashboard Extension	Lists all the process extensions created for the type of Table in view	These are the attributes that were defined in the Packaging and Deploying a Custom Action on page 11.
Variable	To enable in Web client	Yes/No

To Add Data to Tables:

1. Double-click the new table that you created in <u>To Add a Table to Tab</u> on page 66.

2. Click **Attributes** and then the **Add an Attribute** icon to create a new attribute.

> **Note** Agile currently supports Text, Numeric, Image, Date, Money, and Link type data as table attributes. They are listed and defined in Packaging and Deploying a Custom Table DX Source

Figure 12: Sample Dashboard Table DX
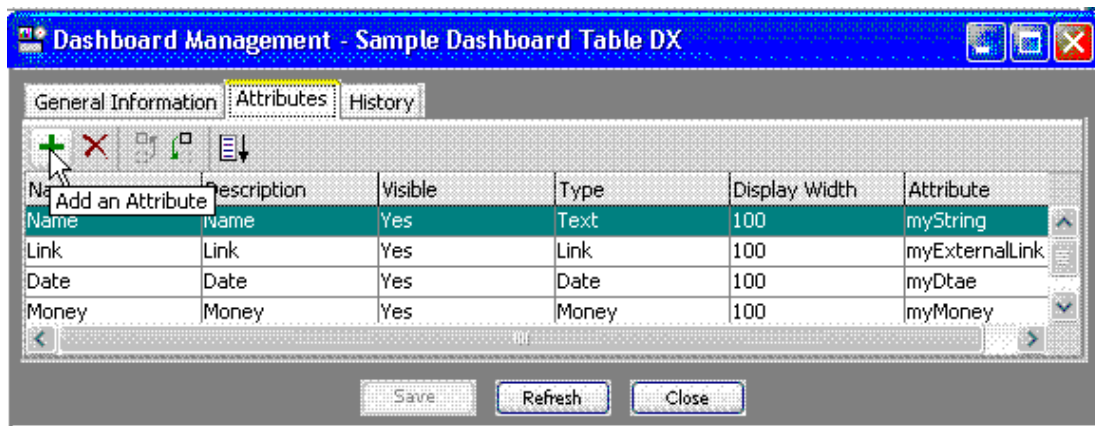
3. In the General Information tab, map the **Attribute** field to the attribute name in the DX.

> **Note** You are now defining the attributes (columns) that will show up in the table on the Dashboard Tab. The property "Attribute" defines the mapping between the data model and the view. For example, if the attribute name in the DX is myString and the selected attribute type is Text, map the attribute field whose attribute name is myString.

4. For more information, refer to the *Agile PLM Administrator Guide*.

Defining Custom (URL) Extensions

A Dashboard PX of the type URL is configured to initiate from Dashboard Management. When defining Custom extensions, simply select Custom as the table type. See "To Add a URL to a Tab" below. No other mapping is required for Dashboard PX's of type URL.

> **Note** URL Process Extensions are defined in the Process Extensions Library to initiate from Dashboard Management.

To Add a URL to a Tab:

1. Define a new tab, for example, Dashboard Extensions as shown above.

2. In the new tab (Dashboard Extensions), click Tables . The Dashboard Management - Dashboard Extensions page appears.

3. In this page, click the **New Dashboard Table** icon to open the Create Dashboard Table dialog

and define the new table.

4.   Select **Custom from View List Type** drop-down list. The **Create Dashboard Table** dialog displaying fields listed in the following appears.

5.   Complete the **Create Dashboard Table** dialog fields and then click **OK**.

Dashboard Table	Description	Possible Settings
Name	Type a name for the URL	String
Description	Type a description	String
View List Type	Lists types of table. Select **Custom**	Chart, Table, Custom, Advance Search
Dashboard Extension	Lists all process extensions created for Custom type list.	Employee Portal, Yahoo, Google, Process Extension_URLs
Visible	To enable in Web Client	Yes/No

Working with Agile PLM Events and Event Context Objects

This chapter includes the following:

Understanding Agile PLM Events and Event Framework

In Agile PLM, Events act as trigger points for generating an automation action within the PLM application. Every Event is generated from a source within Agile PLM applications. The source can be a business action triggered by a user, a UI action, or system initiated source such as a timer. These sources can signal other PLM modules that something (an event) has occurred within the application and it may require an action. The required action can be taken by a user or the PLM module. Event-driven applications greatly facilitate the management of event-based integrations and complex event analysis in real time modes.

In the Agile SDK environment, Event framework extends the PX framework which facilitated automating and extending the Agile PLM Applications. Event framework provides a flexible environment for rapid development and deployment of event-driven applications. To support this environment, Event framework provides a comprehensive set of data parameters to create, configure, and execute different types of Agile PLM Events.

Key Components of an Agile PLM Event

Event framework empowers users to configure Events and Event subscribers. The basic components of Event framework are shown in the following illustration and described in the following paragraphs.

Figure 13: Event components
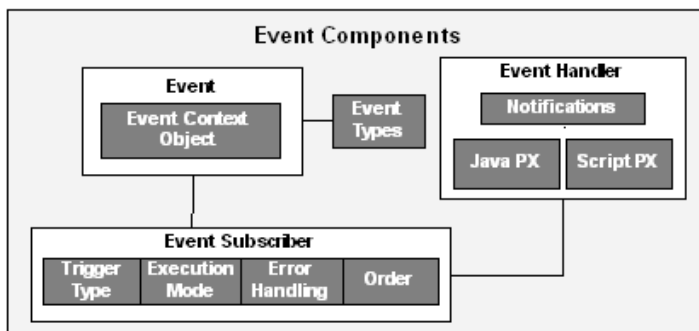
Event Types

In Agile PLM, *Event type* refers to a particular action, for example, *Create Object*, *Delete Object, Audit for Workflow*. Agile PLM provides a list of pre-defined Event types for which an event can occur.

For each Event type, depending on its Handler type, there is a corresponding Java and Script interface for its Event Context object. For example, for *Create Object,* there is the `ICreateEventInfo` Java interface and `ICreateScriptObj` Script interface respectively.

Event type is selected from the drop-down list in Java Client's *Create Event* dialog when the Event is created. To access this dialog, refer to *Agile PLM Administrator Guide*. Default Event types and their descriptions is shown in the figure below.

Figure 14: Event Types and their descriptions

Name ▲	Description
Approve for Workflow	Workflow, Approve
Audit for Workflow	Workflow, Audit
Cancel Check Out Files	Files, Cancel Check Out
Change Approvers or Observers for Workflow	Workflow, Change Approvers or Observers
Change Status for Sourcing Object	Sourcing Object, Change Status
Change Status for Workflow	Workflow, Change Status
Check In Files	Files, Check In
Check Out Files	Files, Check Out
Comment for Workflow	Workflow, Comment
Compliance Rollup on Object	Object, Compliance Rollup
Create Object	Object, Create
Delete Object	Object, Delete
Escalation for Workflow	Workflow, Escalation
Export Object	Object, Export
Extend Actions Menu	Actions Menu, Extend
Extend Tools Menu	Tools Menu, Extend
Get File	File, Get
Incorporate Item	Item, Incorporate
Promotion Failure for Workflow	Workflow, Promotion Failure
Purge Version Files	Files, Purge Version
Reject for Workflow	Workflow, Reject
Reminder for Workflow	Workflow, Reminder
Save As Object	Object, Save As
Scheduled Event	Event, Scheduled
Transfer Authority	Authority, Transfer
Unincorporate Item	Item, Unincorporate
Update Relationship	Relationship, Update
Update Table	Table, Update
Update Title Block	Title Block, Update

Note   You can neither create, or delete these Event types.

Event Handler and Handler Types

An Event Handler represents a custom action that is called when the Event is raised. They extend the function of an action taken by a user, interface, or the system when the Event is triggered. Information about the Event is passed from the Event to the Handler by the *Event Context object*. Handlers are invoked by Event Triggers.

The SDK and Event framework support the following Event Handler types:

- **Java PX –** Java PXs are Java process extensions that implement the `IEventAction` interface in `com.agile.px` package and trigger the compiled Java code. See <u>Event Information Objects</u> on page 79.

- **Script PX – Script PXs are Script process extensions based on Groovy script language**.

  The Groovy script code is directly stored in Agile PLM databases. Event Script objects (Event Script PX handlers) that you develop are text files that are deployed on the Agile PLM server using the Event Management Node in Java Client. For information on submitting the text files, see <u>Working with Agile PLM Administrator</u> on page 110. For information about Groovy implementation in Event framework and Event Script PX development process, see Groovy Implementation in Framework Environment.

- **Notification** – Agile PLM has the capability to send notifications to users, either when the user is required to take action, or to notify the user of actions that have occurred. Notifications can be triggered from the SDK and Script. Event Notifications are addressed in the Agile PLM Administrator Guide. To use the SDK to programmatically send Notifications, refer to "Sending Notifications with Agile SDK" in *SDK Developer Guide - Using Agile APIs.*

Note   SDK developers use the Java PX and Script PX to extend the capabilities of Agile PLM. Notification templates are used by the Agile PLM Administrator to define and configure Notifications for action or information.

Event Subscribers

An Event Subscriber links an Event Handler to a specific Event. Thus, when a particular event occurs, Event Handlers associated with the Event through Event Subscribers are initiated in the order requested by the configuration. The Handler action includes invoking a Java Process Extension, a Script Process Extension, or sending Notifications.

Event Trigger and Trigger Types

Event Trigger is used to determine when an Event Extension is raised. The Event framework provides the hooks to automate actions when an incident happens. For example, when a change of status occurs, a CEO approval is required, the trigger signals the occurrence of an action which will subsequently notify all Event subscribers for that Event. Most Agile PLM Events are associated with business actions. Examples are:

- **Create Object Event** – associated with the object creation action

- **Change Status for Workflow Event** – associated with the Workflow status change action

Event Trigger Types

▫ **Pre** – This trigger type signals a point prior to the occurrence of an action. The Pre trigger is commonly used for events that require data validation or other preparations for the upcoming action. Event Handlers are invoked synchronously from the "**Pre**" trigger point.

▫ **Post** – This trigger type signals a point immediately after the action's changes are committed to the database. The post trigger is commonly used for Events that perform auditing tasks, notifications, and integration tasks with external systems related to the completed action. Event Handlers are invoked synchronously or asynchronously from the "**Post**" trigger point.

Synchronous and Asynchronous Execution Modes

Event Handlers are invoked synchronously or asynchronously. In general, the term synchronous means it is run as part of the application within the current action. A synchronous operation blocks a process until the operation completes, while an asynchronous operation is non-blocking and only initiates the operation.

In Agile PLM, the difference between the two modes is:

▫ **Synchronous** – In this mode, the Event Handler is executed in the same thread (as part of the execution of the action taken) as the Agile PLM thread that triggers the event (for example, a change in a Workflow status). The original Agile PLM action will resume after the handler action is completed.

▫ **Asynchronous** – In this mode, the Event Handler has its own thread (runs independent of the execution of the action taken) and it cannot be stopped once it is started. This transaction is either committed or rolled back based on its own status. The Agile PLM thread that triggers the event will continue to run independently regardless of the Handler action has finished or not (Non-block). Notifications are always handled asynchronously.

Synchronous and Asynchronous Operations in OAS Clusters

PLMs that are configured for operation in clusters use Java Message Service (JMS) for messaging purposes within the cluster. JMS is a Java Message Oriented Middleware (MOM) API for sending messages between two or more clients.

In OAS clusters, JMS resources are hosted only on the primary node, or JMS-host. If the primary node is down, asynchronous Events are still triggered on the secondary node and are set to queued status, but they are never executed. Once the primary node is recovered, depending on the implementation of OAS, asynchronous Events can execute and cause the final result, provided they can pick up the queued JMS messages at the time the system went down. Otherwise, these Events remain in the queue and are never executed.

In these situations, you must stop and restart the cluster, starting with the primary node. If you cannot recover the primary, you must configure the primary (the JMS-host) on another node before starting the cluster. Queued Events do not execute if you drop the primary and continue to use the application on the secondary nodes.

| **Note** | This constraint does not apply to WLS clusters, because WLS supports clustered JMS and has no single "primary" or "JMS-host" node. |

Event Error Handling Rule

Event Error Handling Rule is used in conjunction with Event Handlers executed synchronously. Options are Continue and Stop. The selected option determines the behavior of Agile PLM when an error is encountered while executing the Event Handler. For more information on error handling rules, refer to Agile PLM Administrator Guide.

▫ **Continue** – If there is an error during the execution of a Handler with synchronous execution mode, the error is ignored.

▫ **Stop** – If there is an error during the execution of a Handler with synchronous execution mode, the original action and the Event Subscription is ceased.

Event Order

Event Order is a positive integer that determines the sequential "Order" in which the Event handler is invoked. This allows you to control the execution order of Event Handlers when there are multiple Event Subscribers for the same Event type on the same Agile object.

Note   If you have both Custom PXs and Java synchronous PXs configured for a Workflow Change Status action, Java PXs always execute before Custom PXs.

Event FAQs

This section answers common questions about the Event framework and Java and Script process extensions.

What are the differences between Custom process extensions and Java process extensions (Java PX)?

Similar to Custom process extensions, **Java PXs** also extend the functionality of Agile PLM clients through custom actions. This is done by implementing the `IEventAction` interface in `com.agile.px` in Event framework . Process extensions can be used to connect the Agile PLM server and Agile PLM users to external systems. In addition, Java PXs contain Event Context objects which provide more information than Custom PXs.

Can I use Agile's Java API within a Java process extension program?

Yes. You can use Agile's Java API and other external Java APIs as you did with Custom PXs.

Do Java PXs have special security requirements?

No, similar to Custom PXs.

How are roles and privileges defined for Java PXs/Script PXs?

By default, a custom action (a Handler) uses the roles of the current user. However, if you want to configure a custom action to have expanded privileges, you can specify the roles required for the Handler in the Java Client. When the Handler is executed, the roles specified for the Handler override those of the current user. Once the Handler is completed, the client reverts to the user's original roles and privileges.

Do user assigned roles override roles assigned to a Java or Script PX during configuration?

No. Roles assigned to a Java or Script PX override the user's original roles. Thus all actions that occurred inside the PX Handler are subject to privileges based on these roles. However, the access of the event context object doesn't need the privilege check, including the `getXXX` and `setXXX` method calls.

How do I configure and deploy a Java process extension?

Similar to Custom PXs, place the JAR file(s) for a process extension in the `agile_home/integration/sdk/extensions` folder on the application server. Included with the JAR file(s) should be a file named `com.agile.px.IEventAction` in the META-INF/services directory. The contents of these files are the fully qualified Java class names, one class per line, for an Event action.

After deploying a Java PX on the application server, how do I enable it?

Once Java PX codes are deployed, you can configure them for use within Agile PLM in Java Client by selecting **Admin > Settings > System Settings > Event Management > Event Handlers > New > Create Event Handler > Java PX > Event Action**.

After I've deployed JAR file(s) for a Java PX Handler, do I need to update the application server classpath?

No. The classpath is updated automatically by a special-purpose classloader. The classloader extends the application server classpath with any classes located in agile_home/integration/sdk/extensions (or the location specified for the sdk.extensions property in the agile.properties file).

Which Custom PXs can I migrate to Event framework?

The Event framework supports migrating only Custom Action PXs. These are PXs that are initiated from the Actions Menu, Tools Menu, and Change Status for Workflow.

The corresponding Event types are: Extend Actions Menu, Extend Tools Menu, and Change Status for Workflow.

What error handling rules must the developer/user specify?

For Synchronous Handler, the user must specify the error handling rule to determine how the system reacts if it encounters an error while processing this subscription. The error handling rule only applies to synchronous Handlers. It supports the following two choices, Stop and Continue.

Agile PLM stops any further event processing, and then returns to the originator who raises the event. All remaining synchronous subscribers are not called.

In the case of pre-event, upon receiving the error from the subscriber, the originator simply throws the error to the client that initiates the action and the original action is not performed. The system may also rollback changes made by Handlers. However, whether the transaction can be rolled back or not depends on the Handler type. If it is a Java PX Handler, no transaction rollback is performed because the Handler is the SDK program which has its own transaction.

Do I need to deploy script PXs?

No, Scripts are pasted in the editor in the Script Handler and Agile PLM will store the code in the database. Consequently, programs are delivered in plain text files and not in object code.

Can I send Notifications using Event Handler?

Yes, you can send a Notification from a Java PX and a Script PX.

When should I use scripting?

Use Scripts for prototyping, simple operations, and test driven development.

Do I need to compile my Script code?

No, Script code is validated for syntax errors when you save it in the Handler and will be compiled when the Event is triggered.

What are Dirty files and related methods and interfaces?

They are documented in the Javadoc generated SDK documentation folder under `IEventDirtyRowFileUpdate`. To access the SDK samples folder, see the **Note** in <u>Client-Side Components</u> on page 2.

Can a single action trigger multiple Events?

Yes, for some actions such as Update Multiple Attachment Rows, a single action will trigger multiple Events. In addition, if there are Subscribers for Pre and Post trigger types, then the order in which the Subscribers are invoked can vary depending on the PLM client, the action, and the object type. For example, if you are deleting three rows from an Attachment Table with one Subscriber for the Pre trigger and one Subscriber for the Post trigger, the behavior in PLM clients are as follows:

▫ **Web Client** – A single Update Table Event is triggered

▫ **Java Client** – Three Update Table Events are triggered and one Event for each deleted row as shown below:

- For Changes, Items, TransferOrders, MFR Parts, Suppliers, Sites, Customers, and Package objects, the sequence of the Event Subscribers that are invoked is:
    - Pre (handler from the pre trigger subscriber - for the first row)
    - Pre (handler from the pre trigger subscriber - for the second row)
    - Pre (handler from the pre trigger subscriber - for the third row)
    - Post (handler from the post trigger subscriber - for the first row)
    - Post (handler from the post trigger subscriber - for the second row)
    - Post (handler from the post trigger subscriber - for the third row)
- For Product Service Requests, Quality Change Requests, MFRs, Users and User Groups, the sequence is: Pre - Post - Pre - Post - Pre - Post

Best practices?

▫ What should we avoid in Handlers for Pre-Event?

Use Pre-Event mainly for validation. Although you can modify the Context object, you should avoid direct object updates using SDK calls. (Sometimes, using SDK calls in Pre-Event may cause object version mismatch)

▫ Subscriber Ordering?

Sometimes, for the same event type, you can have the Event Subscribers at Base Class level, Class level, and Subclass level. For example, you may have a number of Event Subscribers for Create Object Event Type: one at Item Base Class level, one at the Part Class level, and one

at the Part Subclass level. If you prefer to execute the Subscribers based on Class hierarchy, it is recommended to allocate an order range for the Base Class, each Class, and each Subclass. For example, you can assign the following range for different Hierarchy levels:

Base Class 0 – 99; Class 100 – 199; Subclass 200 – 299

▫ Can I mix Agile SDK calls and Script PX within Script PX?

You can mix the two as long as you don't use both SDK calls and script PX calls to update Agile objects in the same Handler code. If you want to update the Agile object, you can either use SDK calls or update APIs that are supported by Script Context object, but not both. For procedures, see Accessing SDK with Scripts on page 129.

What are the differences between Variant Management events and other system events?

▫ Variant Management does not have "Pre" or "Post" trigger types. Once an event is enabled, it replaces the system behavior instead of extending it.

▫ Variant Management event types are only applicable to the Model part subtype.

▫ The Variant Management event types are not linked to a specific action only.

▫ Variant Management event types support only one specific execution mode (Synchronous) and error handling rule (Stop).

Working with Event Context Objects

The flowing paragraphs describe the role of Event Context objects, their creation, different Event types, and the information they maintain.

Understanding Event Context Objects

The Context object passes information from the Event to the Handler and between Handlers. When an Event is raised, an Event context object is created. Information maintained by the context object includes Event type, pre- and post-Event triggers, plus business-related data for the given Event, such as the Agile object for which the Event occurred. The business-related data varies based on Event type.

Different Event types have different Context objects. Interfaces for Context objects are documented in Event Information Objects and Event Script Objects. These interfaces are documented in the Javadoc HTML files as *Event Information objects* (Java interfaces) and *Event Script objects* (Script interfaces). To find the Javadoc HTML files in the SDK_samples.zip folder, see the **Note** in Client-Side Components on page 2.

Persistent and Transient Data

In Event framework, objects passed to Event Handlers (Java PX or Script PX) by Context objects contain "Persistent" and "Transient" data.

N o t e   For Variant Management all Context objects contain "Transient" data only.

▫ **Persistent data** – This is data that is already in PLM databases. All Agile SDK APIs and Process Extensions including Web or URL extensions deal with this type of data. When you use `getDataObject()` to get the values of an `IDataObject` object, the data you get is already

in the database, hence "Persistent."

Note	Only the `getDataObject()` method returns Persistent data. Other context object get data methods will return Transient data unless stated otherwise in the Javadoc API definition.

- ▫ **Transient data** – This is data that is not in the PLM database as yet and is in a state of change. Transient data contains information about user requests for the action that triggered the Event.

When the Event is triggered, Agile PLM creates Transient data in the Event Context object. The same Transient data is passed on by the Context object to all Handlers for "Pre" and "Post" unless specified otherwise in the Javadoc API definition.

| **Note**	You must not modify Transient data in the "Post" Event triggering instance. If modified, it will throw an exception. Variant Management events do not have "Pre" or "Post" trigger types. Once a Variant Management event is enabled, it replaces the system behavior instead of extending it.

Event Information Objects

These are the interfaces for the Java PXs.

Event Type	Event Information Object
"Approve for Workflow" and "Reject for Workflow"	`ISignOffEventInfo`
"Audit for Workflow"	`IAuditStatusEventInfo`
"Change Approvers or Observers for Workflow"	`IChangeAppObserverEventInfo`
"Change Status for Sourcing Object"	`ISourcingObjectChangeStatusEventInfo`
"Change Status for Workflow"	`IWFChangeStatusEventInfo`
"Comment for Workflow"	`IRoutableObjectCommentEventInfo`
"Create Object"	`ICreateEventInfo`
"Create Variant Instance", "Derive Variant Model Option BOM", "Update Variant Configuration", "Validate Variant Configuration", "Validate Variant Instance Selections", and "Validate Variant Model Option BOM",	`IVMEventObj`
"Delete Object"	`IDeleteEventInfo`
"Escalation for Workflow"	`IEscalationEventInfo`
"Export Object"	`IExportEventInfo`
"Extend Tools Menu" and "Scheduled Event" and the base interface for all Event information objects	`IEventInfo`
"Get File", "Check In Files", "Check Out Files", and "Cancel Check Out Files"	`IFileEventInfo`
"Incorporate Item", "Unincorporate Item", "Extend Actions Menu", and "Compliance Rollup on Object"	`IObjectEventInfo`

| "Promotion Failure for Workflow"	`IPromotionFailureEventInfo`
"Purge Version Files"	`IPurgeFileEventInfo`
"Reminder for Workflow"	`IReminderEventInfo`
"Save As Object"	`ISaveAsEventInfo`
"Transfer Authority"	`ITransferAuthorityEventInfo`
"Update Table" and "Update Relationship"	`IUpdateTableEventInfo`
"Update Title Block"	`IUpdateTitleBlockEventInfo`

Figure 15: Event information objects class hierarchy
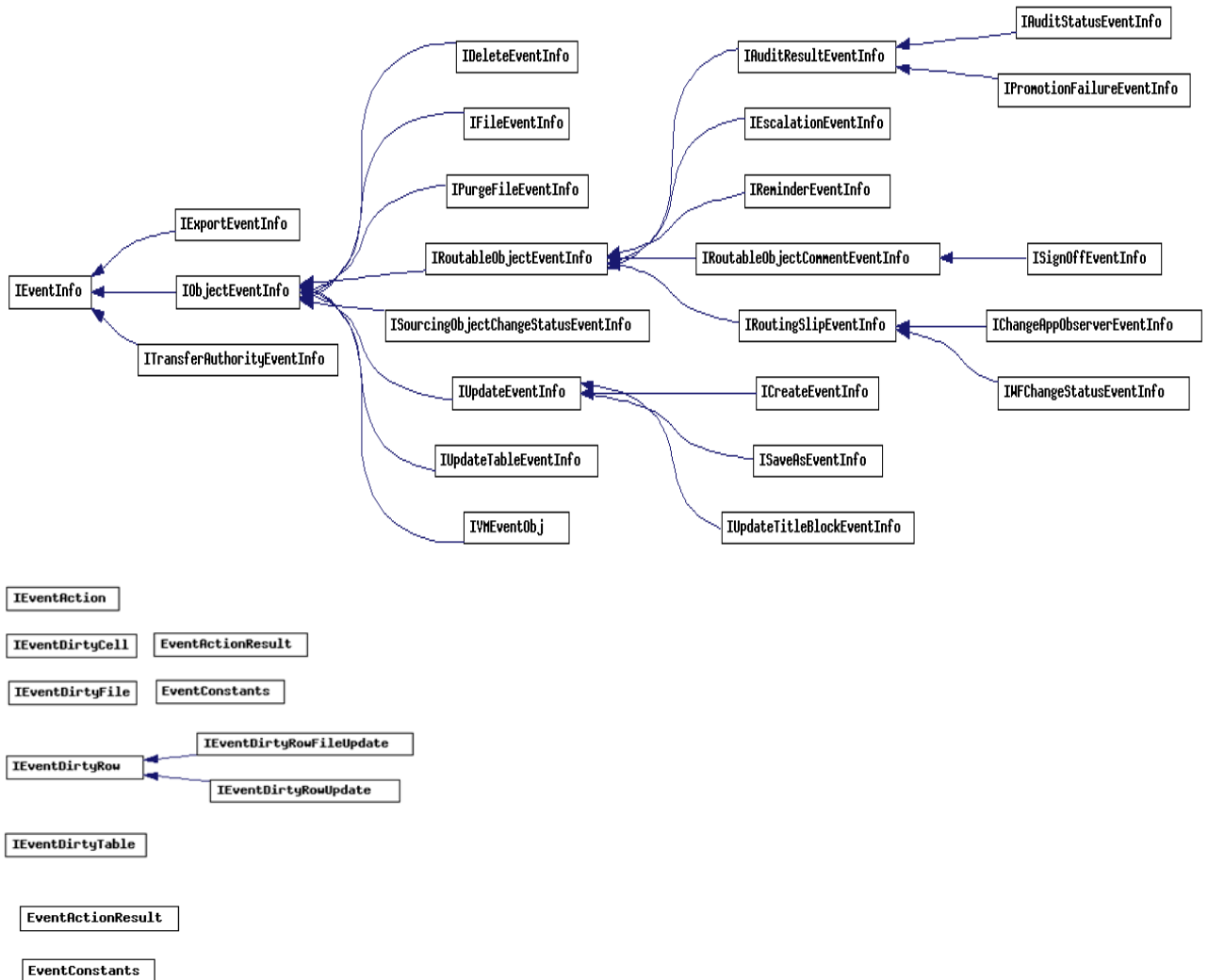
Event Script Objects

These are the interfaces for the Script PXs.

Event Type	Script Object Interface
"Approve for Workflow" and "Reject for Workflow"	`ISignoffScriptObj`
"Audit for Workflow"	`IAuditStatusScriptObj`
"Change Approvers or Observers for Workflow"	`IChangeApproverObserverScriptObj`
"Change Status for Sourcing Object"	`ISourcingObjectChangeStatusScriptObj`
"Change Status for Workflow"	`IChangeStatusScriptObj`
"Comment for Workflow"	`IRoutableObjectCommentScriptObj`
"Create Object"	`ICreateScriptObj`
"Create Variant Instance", "Derive Variant Model Option BOM", "Update Variant Configuration", "Validate Variant Configuration", "Validate Variant Instance Selections", and "Validate Variant Model Option BOM",	`IVMScriptObj`
"Delete Object"	`IDeleteScriptObj`
"Escalation for Workflow"	`IEscalationScriptObj`
"Export Object"	`IExportScriptObj`
"Extend Tools Menu" and "Scheduled Event "Event Script objects, also the base interface for all Event Script objects	`IBaseScriptObj`
"Get File', "Check In Files", 'Check Out Files' and "Cancel Check Out Files"	`IFileEventScriptObj`
"Incorporate Item", "Unincorporate Item", "Extend Actions Menu", and "Compliance Rollup on Object"	`IBaseObjectScriptObj`
"Promotion Failure for Workflow"	`IPromotionFailureScriptObj`
"Purge Version File Folder"	`IPurgeFileScriptObj`
"Reminder for Workflow"	`IReminderScriptObj`
"Save As Object"	`ISaveAsScriptObj`
"Transfer Authority"	`ITransferAuthorityScriptObj`
"Update Table" and "Update Relationship"	`IUpdateTableScriptObj`
"Update Title Block"	`IUpdateTitleBlockScriptObj`

Note In a Script PX, you can invoke any SDK or Java call. You can also access any third party Java or Groovy Libraries if they are deployed in the SDK extensions directory.

Figure 16: Event script objects class hierarchy
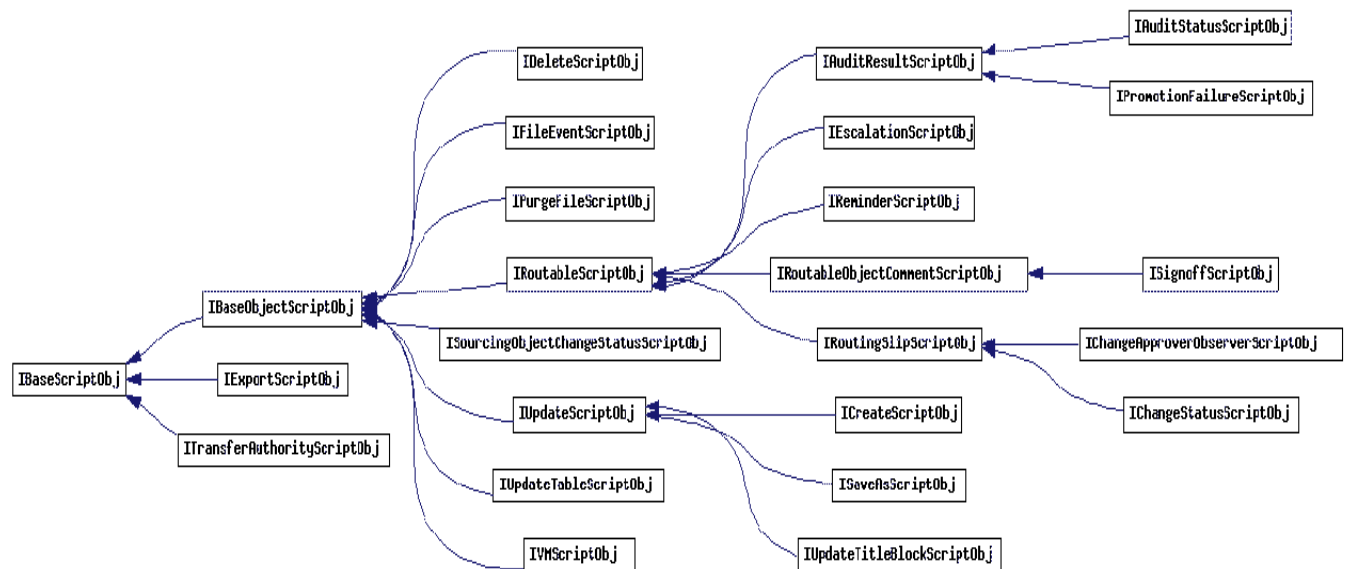
Working with Event Information and Event Script Objects

Information provided in this section uses the Event Information objects and Event Script Objects to develop PX Handlers for Event-related actions, for example, general object actions such as Create Object, Delete Object; Workflow actions such as Change Status for Workflow.

Descriptions and samples for Event Information objects and Event Script objects appear in the following paragraphs. Other information includes code samples using these objects and guidelines to ensure proper handling of special instances of Events in Agile PLM.

Working with Base Event Actions

Base Event Information objects are Java interfaces that are used by all other Event Information objects. See the illustration in <u>Event Information Objects Class Hierarchy</u> on page 82 .

Base Event Information Object - Java PX

The Base Event Information object is `IEventInfo`.

□ Purpose and function – This is the interface for *Extend Tools Menu* and *Scheduled Event* Event Information objects. In addition, `IEventInfo` is the inherited interface for all Event Information objects. It maintains information on Event type, Event trigger type, Event name, Event Subscriber name, Event Handler name, and user defined Maps.

User defined Maps serve as a place holder for any user defined data and provide a communication channel between subscribers. They are set in the Synchronous Java PXs and read by subsequent Synchronous Java PXs and Asynchronous Java PXs. Maps set inside Asynchronous PXs cannot be used by other Java PXs. If the Java PX fails, the Map is still accepted by Agile PLM and is passed to the next Java PX but all other changes in the Event Context objects are discarded.

`IObjectEventInfo` is the base event information object for object-related events.

▫ Purpose and function – `IObjectEventInfo` contains the Agile object for which the Event is triggered. Also, it is the interface for Incorporate Item, Unincorporate Item, Extend Actions Menu, and Compliance Rollup on object Event Information objects, and inherits from `IEventInfo`.

▫ **Inherited interface:** `IEventInfo`

These examples show using `IEventInfo` and `IObjectEventInfo`.

Example: Using IEventInfo

```
private void testIEventInfo(IEventInfo req)throws APIException{
    // getEventType()
    int evttype = req.getEventType();

    // getEventTriggerType()
    int evtTriggerType = req.getEventTriggerType();
    // getEventName()
    String eventName = req.getEventName();

    // getEventSubscriberName()
    String subscriberName = req.getEventSubscriberName();
    // getEventHandlerHame()
    String handlerName = req.getEventHandlerName();
    // setUserDefinedMap()
    Map map = new HashMap();
    map.put("METHOD", "setUserDefinedMap()");
    req.setUserDefinedMap(map);

    // getUserDefinedMap()
    Map map2 = new HashMap();
    map2 = req.getUserDefinedMap();
    String mapValue = map2.get("METHOD").toString();
}
```

Example: Call made by IObjectEventInfo

```
private void testIObjectEventInfo(IEventInfo req)throws APIException{
    String objNumber = "";
    IObjectEventInfo info = (IObjectEventInfo)req;

    // getDataObject()
    IDataObject obj = info.getDataObject();
    if (obj==null)
            objNumber = "NULL";
    else
            objNumber = obj.getName();
    }
```

Base Event Script Objects - Script PX

Base Event Script object is `IBaseScriptObj`.

▫ Purpose and function – This is the interface for *Extend Tools Menu* and *Scheduled Event* Event Script objects. `IBaseScriptObj` is the inherited interface for all Event Script objects. `IBaseScriptObj` maintains information on Event type, Event trigger type, Event name, Event Subscriber name, Event Handler name, and User Defined Maps.

> **Note** This interface provides a Script method for sending Agile PLM Notifications.

`IBaseObjectScriptObj` is the base event information object for object-related events.

▫ Purpose and function – `IBaseObjectScriptObj` contains the Agile object for which the Event is triggered. Also, it is the interface for Incorporate Item, Unincorporate Item, Extend Actions Menu, and Compliance Rollup on object Event Information objects and inherits from `IBaseScriptObj`.

▫ **Inherited interface:** `IBaseScriptObj`

The following examples show using `IBaseScriptObj` and `IBaseObjectScriptObj`.

Example: Using IBaseScriptObj

This example opens the SDK session and retrieves information pertaining to the Event.

```
void invokeScript(IBaseScriptObj obj)
{
// getEventType()
    int evttype = obj.getEventType();
// getEventTriggerType()
    int evtTriggerType = obj.getEventTriggerType();
// getEventName()
    String eventName = obj.getEventName();
// getEventSubscriberName()
    String subscriberName = obj.getEventSubscriberName();
// getEventHandlerHame()
    String handlerName = obj.getEventHandlerName();
//logMonitor ()
    obj.logMonitor("Status is Passed");
//getAgileSDKSession()
    IAgileSession session = obj.getAgileSDKSession();
//getPXEventInfo ()
    IEventInfo req = obj.getPXEventInfo();
//sendNotification()
    obj.sendNotification("Test", true, [ "admin"],  " passed from
    BaseScriptObj" + eventName);
// setUserDefinedMap()
    obj.setUserDefinedMap ( [ 'Agile 93' :  'PLM Product',
    'Scripting':'Is Fun Tool']);
// getUserDefinedMap()
```

```
        Map myMap = obj.getUserDefinedMap ();


 }
```

Example: Using IBaseObjectScriptObj

`IBaseObjectScriptObj` retrieves Class ID and object number and sets P1, P2, and P3 attribute values of the object.

```
 void testIBaseObjectScriptObj(IBaseObjectScriptObj obj)
 {
    String objNumber = "";
    //Disable all the warning exceptions raised
    obj.disableAllWarnings();

    //get class ID
    int classID = obj.getClassId();

    //get object number
    objNumber = obj.getObjectNumber();

    //set attributes
    obj.setValueByAttId(CommonConstants.ATT_PAGE_TWO_TEXT01,"Text
    Value");
    // setValueByAttId one from each attribute type
    /*
    * Date:      Page Two.Date01
    * Text:      page Two.Text01
    * MultiText: Page Three.MultiText10
    * List:      Page Two.List01
    * MultiList: Page Three.MultiList01
    * Numeric:   Page Two.Numeric 01
    * Money:     Page Three.Money01
    */

    // get attribute value
    obj.getValueByAttId(CommonConstants.ATT_PAGE_TWO_TEXT01);
    //log information to handler monitor
    obj.logMonitor("Object Number:" + objNumber);
    obj.logMonitor("Class Id :" +  classID);
 }
```

Working with General Object Actions

General Object actions are actions such as Create, Delete, Save As, and Update Title block. Information objects and Script Event objects for these Events are grouped and described according to their inherited interfaces.

General Object Actions - Java PX

Create Object

The Information object for this Event is `ICreateEventInfo`.

□   **Purpose and function** – `ICreateEventInfo` retrieves the number and Subclass identifier of the requested new object. It can also overwrite the number and Subclass set by the clients.

□   **Inherited interfaces** – `IUpdateEventInfo` , `IObjectEventInfo`, `IEventInfo`

□   **Inherited interface purpose and function:**

- `IObjectEventInfo`

- `IUpdateEventInfo` retrieves the Array of Dirty attributes that users can overwrite or set with new attributes and values.

The following examples show using `ICreateEventInfo` and `IUpdateEventInfo`.

Example: Using ICreateEventInfo

```
private void testICreateEventInfo(IAgileSession session, IEventInfo
req) throws APIException {
      ICreateEventInfo info = (ICreateEventInfo)req;
      String number = "";
      Integer subclass = null;
      String newNumber = getNewNumber(info);  // user defined method
      Integer newSubclassId = getNewSubclassId(session, req); // user
      defined method
      Integer newSubclass = null;
      // getNewNumber()
      number = info.getNewNumber();

      // getNewSubclassId()
      subclass = info.getNewSubclassId()

      // setNewNumber()
      info.setNewNumber(newNumber);

      // setNewSubclassId()
      info.setNewSubclassId(newSubclassId);
      newSubclass = info.getNewSubclassId();
 }
```

Example: Using IUpdateEventInfo

```
private void testIUpdateEventInfo(IAgileSession session, IEventInfo
req) throws Exception {
   // Interface methods
   IUpdateEventInfo info = (IUpdateEventInfo)req;


   //getCells()
   IEventDirtyCell[] cells = info.getCells();
   // getAttributeIds()
```

```
Integer[] attrs = info.getAttributeIds();

// setCell()
// Get class specific P1 attribute
Integer p1attrId = getP1Attribute(session, info);

// Override client value
info.setCell(p1attrId, "set desc from CO");


// Add new Dirty value
info.setCeldirtyl(CommonConstants.ATT_PAGE_TWO_TEXT02, "setCell()");
String value2 =
info.getValue(CommonConstants.ATT_PAGE_TWO_TEXT02).toString();
// setCell() one from each attribute type
* Date:       Page Two.Date01
* Text:         already cover
* MultiText: Page Three.MultiText10
* List:       Page Two.List01
* MultiList: Page Three.MultiList01
* Numeric:   Page Two.Numeric 01
* Money:     Page Three.Money01
*/

Integer subClassId = getSubclassId(info);
IAttribute attr1 =
    session.getAdminInstance().getAgileClass(subClassId).getAttribute
    (CommonConstants.ATT_PAGE_TWO_LIST01);
IAttribute attr2 =
    session.getAdminInstance().getAgileClass(subClassId).getAttribute
    (CommonConstants.ATT_PAGE_THREE_MULTILIST01);
IAgileList list1 =
    (IAgileList)attr1.getAvailableValues();
list1.setSelection(new Object[]{"b"});
IAgileList list2 = null;
if (attr2!=null){
    list2 = (IAgileList)attr2.getAvailableValues();
    list2.setSelection(new Object[]{"a", "b", "e"});
}
SimpleDateFormat df = new SimpleDateFormat("MM/dd/yyyy");
String d = "1/31/2009";
Date date = df.parse(d);
info.setCell(CommonConstants.ATT_PAGE_TWO_DATE01, date);
String multitext = "set multitext field in CO";
info.setCell(CommonConstants.ATT_PAGE_TWO_LIST01, list1);
info.setCell(CommonConstants.ATT_PAGE_TWO_LIST02, list1); // To test
IEventDirtyCell
info.setCell(CommonConstants.ATT_PAGE_TWO_NUMERIC01, 888.66);
if (attr2!=null){
    info.setCell(CommonConstants.ATT_PAGE_THREE_MULTITEXT10,
    multitext);
    info.setCell(CommonConstants.ATT_PAGE_THREE_MULTILIST01, list2);
}
```

```
    Money money = new Money (new Integer(100), "USD");
    // removeCell()
    info.removeCell(CommonConstants.ATT_PAGE_THREE_TEXT01);

}
```

Update Title Block

The Information object for this Event is `IUpdateTitleBlockEventInfo`.

□   **Purpose and function** – `IUpdateTitleBlockEventInfo` is the interface for Update Title Block Event information object. Checks whether this is a redline update or undo-redline update on the Title Block of `IItem` object which has originated from the Affected Items table of the `Change` object

□   **Inherited interfaces** – `IUpdateEventInfo`, `IObjectEventInfo, IEventInfo`

Save As Object

The Information object for this Event is `ISaveAsEventInfo`.

□   **Purpose and function** – `ISaveAsEventInfo` performs the following tasks:
    • Retrieves the number and Subclass of the newly saved object
    • Overwrites the number and Subclass that are set by PLM clients

□   **Inherited interfaces** – `IUpdateEventInfo`, `IObjectEventInfo, IEventInfo`

Delete Object

The Information object for this Event is `IDeleteEventInfo`.

□   **Purpose and function** – `IDeleteEventInfo` is the interface for Delete Event information object. It performs the following tasks:
    • Retrieves the number and Subclass of the newly deleted object
    • Checks if the action performed is a *soft* or *hard* delete

□   **Inherited interfaces** – `IObjectEventInfo, IEventInfo`

Export Object

The Information object for this Event is `IExportEventInfo`.

□   **Purpose and function** – `IExportEventInfo` performs the following tasks:
    • Retrieves the format of the export file
    • Returns the array of objects that are exported
    • Returns the tables for exporting the object

□   **Inherited interfaces** – `IEventInfo`

Working with General Base Event Script Objects

Create Object

The Script Event object for this Event is `ICreateScriptObj`.

□ **Purpose and function** – The same as `ICreateEventInfo`

□ **Inherited interfaces** – `IUpdateScriptObj, IBaseObjectScriptObj, IBaseScriptObj`

□ **Inherited interface purpose and function** – The same as `IUpdateEventInfo`, `IObjectEventInfo` and `IEventInfo`

The following examples show using `ICreateScriptObj` and `IUpdateScriptObj`.

Example: Using ICreateScriptObj

```
// In the example, ICreateScriptObj modifies the number and class ID of
the new object.
void testICreateScriptObj(IBaseScriptObj obj)
{
        String origNumber = "";
        String newNumber = "";
        int newSubclassId =
            ItemConstants.CLASS_DOCUMENT ; // new subclass ID of choice
        int newSubclass ;
        int subclass;
        // getNewNumber()
        origNumber = obj.getNewNumber();
        newNumber = origNumber +"new";

        // setNewNumber()
        obj.setNewNumber(newNumber);
        newNumber = obj.getNewNumber();

        // getNewSubclassId()
        subclass = obj.getNewSubclassId();

        // setNewSubclassId()
        obj.setNewSubclassId(newSubclassId);
        newSubclass = obj.getNewSubclassId();

        // log new object number and new subclass ID in to handler
        monitor
        obj.logMonitor("new object number is:" + newNumber);
        obj.logMonitor("new subclass ID is:" + newSubclass);
}
```

Example: Using IUpdateScriptObj

```
// In this example, IUpdateScriptObj gets the ID and value of Dirty
attributes, sets Dirty attribute values from context object, and
removes the value of Dirty attributes.
void testIUpdateScriptObj(IBaseScriptObj obj)
```

```
{
    String dirtyAttr = "";
    String dirtyValue = "";

    // get Attribute Ids
    int[] attrs = obj.getAttrIds();
    attrs.each {attr->

    // get Attribute value
    dirtyAttr = obj.getDirtyAttr(attr);

    // log attribute Id and value in to handler monitor
    obj.logMonitor("Dirty Attr Id :" + attr);
    obj.logMonitor(" dirty Attr value:" + dirtyAttr);
    }

    // Overwrite client value
    obj.setDirtyAttrValue(CommonConstants.ATT_PAGE_TWO_TEXT02, "set text
    value from CO");
    //Remove Dirty Attribute value
    obj.removeDirtyAttr(CommonConstants.ATT_PAGE_TWO_TEXT02);
    // get dirty attribute value after removing value from CO
    dirtyValue =
    obj.getDirtyAttrValue(CommonConstants.ATT_PAGE_TWO_TEXT02);
    //log original attribute value in to handler monitor
    obj.logMonitor("Attribute value after remove:" + dirtyValue);
}
```

Update Title Block

The Script Event object for this Event is `IUpdateTitleBlockScriptObj`.

▫ **Purpose and function** – `IUpdateTitleBlockScriptObj` checks whether this is a redline update or undo-redline update on the Title Block of the `IItem` object which has originated from the Affected Items table of `Change` object

▫ **Inherited interfaces** – `IUpdateScriptObj, IBaseObjectScriptObj, IBaseScriptObj`

Save As Object

Script Event object for this Event is `ISaveAsScriptObj`.

▫ **Purpose and function** – `ISaveAsScriptObj` retrieves the name or number for the new object.

▫ **Inherited interfaces** – `IUpdateScriptObj, IBaseObjectScriptObj, IBaseScriptObj`

Delete Object

The Information object for this Event is `IDeleteScriptObj`.

▫ **Purpose and function** – `IDeleteScriptObj` deletes the Event Script object.

▫ **Inherited interfaces** – `IBaseObjectScriptObj, IBaseScriptObj`

Export Object

Script Event object for this Event is `IExportScriptObj`.

▫ **Purpose and function** – `IExportScriptObj` retrieves the format for the export object.

▫ **Inherited interfaces** – `IBaseScriptObj`

Example: Using IExportScriptObj

```
In this example, IExportScriptObj retrieves information about the
object that is exported.
void testIExportScriptObj(IBaseScriptObj obj)
{
    int format;
    int[] selectedTables =
    String objects ="";
    String user = "";
    String objectNumber =
          "P00002" ; // the object number being exported
// get current user
    obj.getCurrentUser();
// get file format for the export.
    format = obj.getExtractedFormat();
// get list of Object Names being exported
    objects = obj.getExtractedObjects();
// get tables selected for export
    selectedTables = obj.getSelectedTables(objectNumber);
// log current user, extracted format, object names and tables which
exported into handler monitor
       obj.logMonitor("current user is:" + user);
       obj.logMonitor("file format is:" + format);
       obj.logMonitor("Object Names are:" + objects);
       obj.logMonitor("Selected Tables are:" + selectedTables);

}
```

Working with Table and Relationship Actions

These actions include updating the supported object tables for specific business objects.

Table and Relationship Actions - Java PX

Update Table

The Information object for this Event is `IUpdateTableEventInfo`.

▫ **Purpose and function** – `IUpdateTableEventInfo` is the interface for *Update Table* and *Update Relationship*. It retrieves the Dirty table for the affected object.

▫ **Inherited interfaces** – `IObjectEventInfo` and `IEventInfo`. See <u>Base Information Objects - Java PX</u> on page 82.

□   Related interfaces:

- `IEventDirtyFile` is the interface for a Dirty file associated with `IEventDirtyRowFileUpdate` or `IFileEventInfo`. It represents a single row in a file table and retrieves the checkout date of the Dirty file.

- `IEventDirtyTable` is the interface for a Dirty table associated with `IUpdateTableEventInfo` or `IEventDirtyRow`. The Dirty table contains a collection of modified rows. It provides access to transient table information for modified tables.

- `IEventDirtyCell` is the interface for a Dirty cell associated with `IEventDirtyRowUpdate` or `IUpdateEventInfo`. Represents a single cell in a row. It returns the attribute identifier corresponding to this Dirty cell.

- `IEventDirtyRowFileUpdate` retrieves the Dirty file. It is the interface for a Dirty row used to perform Dirty Row Actions (Add file, Replace file).

- `IEventDirtyRowUpdate` retrieves the Dirty row for which the update occurs. This interface is used by the update on all tables except the attachment table.

Note   You can find information on "Dirty" objects in the SDK samples Documentation folder. To access this folder, see the **Note** in Client-Side Components on page 2.

These examples use `IEventDirtyTable` and `IEventDirtyRowUpdate` on an Item BOM table.

Example: Using IEventDirtyTable

```
private void testIEventDirtyTable(IAgileSession session,
IEventDirtyTable table, IDataObject obj, int evtTriggerType) throws
Exception {
//getTableId()
    String tableName = getTableName(obj, table);
// size()
    int size = table.size();
//iterator()
    Iterator it = table.iterator();
    while (it.hasNext()){
        IEventDirtyRow row = (IEventDirtyRow)it.next();
        if(row.getAction()!=EventConstants.DIRTY_ROW_ACTION_ADD_FILE&&row
        .getAction()!=EventConstants.DIRTY_ROW_ACTION_REPLACE_FILE)
//user defined method
            testIEventDirtyRowUpdateCommon(session, row, obj,
            evtTriggerType);
        else
            testIEventDirtyRowFileUpdate(row);// user defined method
    }

}
```

Example: IEventDirtyRowUpdate on Item BOM table

```
private void
testIEventDirtyRowUpdate_ItemBOM_Update(IEventDirtyRowUpdate row,
IDataObject obj) throws Exception {
```

```
IEventDirtyCell[] cells1 = row.getCells();
readCells(cells1);  // user defined method


    /* setCell() - Override
    * List01 ==> c
    * MultiText30 ==> setCell() on update
    * Text01 ==> setCell()on update
    * Numeric01 ==> 888.66
    * BOM Notes ==> setCell() from CO
    */
//List01
    IAttribute attrList =
    obj.getAgileClass().getAttribute(ItemConstants.ATT_BOM_BOM_LIST01);
    IAgileList list =
    (IAgileList)attrList.getAvailableValues();

    list.setSelection(new Object[]{"c"});
    row.setCell(ItemConstants.ATT_BOM_BOM_LIST01, list);
//MultiText30
    row.setCell(ItemConstants.ATT_BOM_BOM_MULTITEXT30, "setCell() MT30
    update");
//Text01
    row.setCell(ItemConstants.ATT_BOM_BOM_TEXT01, "setCell() T01
    update");
// Numeric01
    row.setCell(ItemConstants.ATT_BOM_BOM_NUMERIC01, 888.66);
// BOM Notes
    row.setCell(ItemConstants.ATT_BOM_BOM_NOTES, "setCell() Notes
    update");


/*
* setCell() - New
* List02 ==> a
* Text02 ==> setCell() on update
*/


// List02
    row.setCell(ItemConstants.ATT_BOM_BOM_LIST02, list);
//Text02
    row.setCell(ItemConstants.ATT_BOM_BOM_TEXT02, "setCell() T02
    update");
// Qty
    row.setCell(ItemConstants.ATT_BOM_QTY, new Integer(2));
//removeCell() ==> Date01 & Find Num
    row.removeCell(ItemConstants.ATT_BOM_BOM_DATE01);
    row.removeCell(ItemConstants.ATT_BOM_FIND_NUM);
// getCell()
```

```
    IEventDirtyCell cell =
    row.getCell(ItemConstants.ATT_BOM_BOM_LIST02);
}
```

Update Relationship

See Update Table in <u>Table and Relationship Actions - Java PX</u> on page 91.

Table and Relationship Actions - Script PX

Update Table

The Script Event object for this Event is `IUpdateTableScriptObj`.

- ▢ **Purpose and function** – `IUpdateTableScriptObj` is the interface for Update Table and Update Relationship. It retrieves the dirty table for the affected object.

- ▢ **Inherited interfaces** – `IBaseObjectScriptObj`. See <u>Base Event Script Objects - Script PX</u> on page 83 .

- ▢ Related interfaces:

  - `IEventDirtyRow` is the base interface for a dirty row associated with `IUpdateTableScriptObj`. It represents a single row in a table. There is an action associated with the row.

  - `IEventDirtyRowFileUpdate` retrieves the dirty file row. It is the interface for a dirty file row used to perform Dirty File Row Actions (Add file, Replace file).

  - `IEventDirtyRowUpdate` retrieves the Dirty row. It is the interface for a Dirty row used to perform Dirty Row Actions (Add, Delete, Update, Redline Add, Redline Delete, Redline Update, Undo Redline.)

  - `IEventDirtyFile` is the interface for a Dirty file associated with `IEventDirtyRowFileUpdate` or `IFileEventInfo`. It represents a single row in a file table and retrieves the checkout date of the Dirty file.

The following examples show using `IEventDirtyTable` and `IEventDirtyRowUpdate` on an Item BOM table.

Example: Using IEventDirtyTable

```
// IUpdateTableScriptObj: get table id and Dirty row ids
    void testIUpdateTableScriptObj(IBaseScriptObj obj)
{
//getTableId()
    int table_id= obj.getTableId();
    obj.logMonitor("Table Id" + table_id);

// getDirtyRowIds()
    rowIDs =obj.getDirtyRowIds();
    rowIDs.each{rID->   //loop through Dirty rows
    obj.logMonitor("rowID is " + rID);

//getDirtyRow()
```

```
    row = obj.getDirtyRow(rID);
// getAction
    action = row.getAction();
    obj.logMonitor ("Action" + action);


    if ((action == EventConstants.DIRTY_ROW_ACTION_ADD_FILE) || (action
    == EventConstants.DIRTY_ROW_ACTION_REPLACE_FILE))
            testIEventDirtyRowFileUpdate(obj,row,rID); // user method

    else
            testIEventDirtyRowUpdate(obj,row,rID); // user method
}
```

Example: Using IEventDirtyRowUpdate

```
//This Item BOM table example gets the object number and action for a
single row associated with IUpdateTableScriptObj.
void testIEventDirtyRowUpdate(IBaseScriptObj obj,IEventDirtyRow row,
int rID )
{


//getRowId()
    int rid = row.getRowId();
// getObjectNumber()
    int rnumber = row.getObjectNumber();
    obj.logMonitor("row object" + rnumber);


// getDirtyRow
    dirtyRow = obj.getDirtyRow(rID);
//from client, update following attributes in Bom table
// find number,Bom notes, Multi Text01,List01,date01, Text01, numeric0
//getDirtyAttrIds()
      dirtyAttrs = dirtyRow.getDirtyAttrIds();
      def sort_attrs = dirtyAttrs as List;
      sort_attrs.sort(); //sort attribute Ids


// getDirtyAttrValue()
      sort_attrs.each {dirtyAttr->
      attrValue =  dirtyRow.getDirtyAttrValue(dirtyAttr);
      obj.logMonitor('***'+"attribute value" +'=' + attrValue);
      }


// array of vlues to overwrite attributes from Context object
//[find number,Bom notes, Multi Text01,List01,date01, Text01,
numeric01]
      set_dirty_value = ["5","Bom Note","Multi text 03","e","2009-01-30
      08:00:00","Text 01","224466"];
//setDirtyAttrValue , overwrite attribute values
      int indexy =0;
```

```
        sort_attrs.each{att->
        dirtyRow.setDirtyAttrValue(att , set_dirty_value[indexy++]);
        }

 // getDirtyAttrValue() after overwrite in CO
        int indexB=0;
        sort_attrs.each {dirtyAttr->
        attrValue2 =  dirtyRow.getDirtyAttrValue(dirtyAttr);
        all_attrValue2[indexB++]= attrValue2;
        }

 // removetDirtyAttr() remove dirty attributes and rollback changes

        sort_attrs.each {dirtyAttr->
        dirtyRow.removetDirtyAttr(dirtyAttr);
    }
 }
```

Update Relationship

See Update Table in <u>Table and Relationship Actions - Java PX</u> on page 91.

Working with Variant Management Events

Variant Management events include:

▫   Create Variant Instance

The event handler creates the derived Instance BOM.

▫   Derive Variant Model Option BOM

The event handler creates the logical structure of the Instance BOM without actually creating new items or changing the BOM tab of an item.

▫   Update Variant Configuration

The event handler adds or removes configuration options and runs propagations and pre-selections.

▫   Validate Variant Configuration

The event handler checks the consistency of the Configuration Graph and the Model Option BOM.

▫   Validate Variant Instance Selections

The event handler checks validation rules for the configuration, e.g. minimum/maximum violations, or if an Option Class has sufficient number of valid child options.

▫   Validate Variant Model Option BOM

The event handler checks validation rules on the Model Option BOM, e.g. if the minimum quantity value is smaller/equal to the maximum quantity value, or if an Option Class has valid child options.

These events can only be triggered on Model part subtype. Once the event is enabled, it replaces the system behavior instead of extending it.

Note	The Variant Management SPX and JPX default scripts can be downloaded from Oracle Agile PLM's Event and Web Services Samples Web site. See the **Note** in Client-Side Components on page 2.

Variant Management Events - Java PX

The information object for these Events is `IVMEventObj`:

▫ Create Variant Instance

▫ Derive Variant Model Option BOM

▫ Update Variant Configuration

▫ Validate Variant Configuration

▫ Validate Variant Instance Selections

▫ Validate Variant Model Option BOM

`IVMEventObj` is the interface for the Variant Management events information object. It provides access to the Configuration Graph, the Model Option BOM and the Instance BOM (if available).

Note	You can find more information on the purpose and function of these Events and when they are triggered, in the *Agile PLM Administrator Guide* and the chapter entitled "Configuring Variant Management" in *Agile PLM Product Collaboration User Guide.*

Inherited interfaces - `IObjectEventInfo, IEventInfo`

The following example shows how to use `IVMEventObj`:

```
    private void testIVMEventObj(IVMEventObj req) {
        // get configuration graph
         IConfigurationGraph graph = req.getConfigurationGraph();
        // get Model Option BOM
        IModelOptionBOM mob = req.getModelOptionBOM();
        // getting unique id of item that has been
 selected/deselected/modified
        // by the user
        IUniqueId currentId = req.getCurrentUniqueId();
        IModelOptionBOMItem item = mob.findItem( currentId);
        graph.selectOption( item );
    }
```

Variant Management Events - Script PX

The information object for these Events is `IVMScriptObj`:

▫ Create Variant Instance

▫ Derive Variant Model Option BOM

▫ Update Variant Configuration

▫ Validate Variant Configuration

▫ Validate Variant Instance Selections

▫ Validate Variant Model Option BOM

`IVMScriptObj` is the interface for the Variant Management events information object. It provides access to the Configuration Graph, the Model Option BOM and the Instance BOM (if available).

Note   You can find more information on the purpose and function of these Events and when they are triggered, in the *Agile PLM Administrator Guide* and the chapter entitled "Configuring Variant Management" in *Agile PLM Product Collaboration User Guide.*

Inherited interfaces - `IBaseObjectScriptObj, IBaseScriptObj`

The following example shows how to use `IVMScriptObj`:

```
void testIVMEventObj(IBaseScriptObj obj) {
        // get configuration graph
         IConfigurationGraph graph = obj.getConfigurationGraph();
        // get Model Option BOM
        IModelOptionBOM mob =  obj.getModelOptionBOM();
        for ( IConfigurationOption option in graph ) {
          IModelOptionBOMItem mobItem = mob.findItem(
option.getUniqueId() );
          if (option.getQuantity() > mobItem.getMaxQuantity()) {
              obj.addErrorMessage( option, "Quantity must not be
greater than max. quanity())
          }
    }
```

Working with Workflow Object Actions

These are Workflow-related actions such as, Change Status for Workflow, Change Approvers or Observers for Workflow, and change the status of Product Cost Management's Sourcing Project.

Workflow Object Actions - Java PX

Change Status for Workflow

The Information object for this Event is `IWFChangeStatusEventInfo`.

▫ **Purpose and function** – `IWFChangeStatusEventInfo` retrieves changes in Workflow status of the object and assigned notifiers and checks whether the "auto-promote" flag is set or not set.

▫ **Inherited interfaces** – `IRoutingSlipEventInfo`, `IRoutableObjectEventInfo`, `IObjectEventInfo, IEventInfo`

▫ **Inherited interfaces purpose and function**:

- `IRoutingSlipEventInfo` – **Is the inherited** interface for all Event Information objects that contain the Routing slip Object and provides methods to set/get approvers, observers, comments, and urgent flags

- `IRoutableObjectEventInfo` – **Is the inherited** interface for all Event Information objects related to workflow actions and provides methods such as get/set approvers or observers

The following examples show using `IWFChangeStatusEventInfo`, `IRoutingSlipEventInfo`, and `IRoutableObjectEventInfo`.

Example: Using IWFChangeStatusEventInfo

```
private void testIWFChangeStatusEventInfo(IAgileSession session,
IEventInfo req) throws APIException {
   IWFChangeStatusEventInfo info = (IWFChangeStatusEventInfo)req;
   //getNotifiers()
   IDataObject[] notifiers = info.getNotifiers();

   // isAutoPromote()
   boolean isAutoPromote = info.isAutoPromote();
   // setNotifiers()
   IUser user = getUser(session, "yvonnec");
   IUserGroup ug = getUserGroup(session, "SOA");
   Collection col = new ArrayList();
   col.add(user);
   col.add(ug);
   info.setNotifiers(col);

   // getFromStatus()
   IStatus fromStatus = info.getFromStatus();

   // getToStatus()
   IStatus toStatus = info.getToStatus();
}
```

Example: Using IRoutingSlipEventInfo

```
private void testIRoutingSlipEventInfo(IAgileSession session,
IEventInfo req) throws APIException {
   IRoutingSlipEventInfo info = (IRoutingSlipEventInfo)req;
   Collection colAppvrs = new ArrayList();
   Collection colObsvrs = new ArrayList();
   Collection colNewAppvrs = new ArrayList();
```

```
    Collection colNewObsvrs = new ArrayList();
    String newComments = "Override in context object.";

    //getApprovers()
    IDataObject[] approvers = info.getApprovers();
    String approverList = arrayToString(approvers);

    //getObservers()
    IDataObject[] observers = info.getObservers();

    //getComments()
    String comments = info.getComments();

    //isUrgent()
    boolean isUrgent = info.isUrgent();

    //setApprovers()
    IUser user1 = getUser(session, "badriv");
    IUser user2 = getUser(session, "albertl");
    IUser user3 = getUser(session, "brucec");
    IUserGroup ug1 = getUserGroup(session, "SOA");

    colAppvrs.add(user1);
    colAppvrs.add(user2);
    colObsvrs.add(user3);
    colObsvrs.add(ug1);

    info.setApprovers(colAppvrs);
    IDataObject[] newApprovers = info.getApprovers();
    //setObservers()
    info.setObservers(colObsvrs);
    IDataObject[] newObservers = info.getObservers();

    //setComments()
    info.setComments(newComments);
    String latestComments = info.getComments();

    //setUrgent()
    boolean newUrgent = getOppositeBoolean(isUrgent);
    info.setUrgent(newUrgent); boolean latestUrgent = info.isUrgent();
}
```

Example: Using IRoutableObjectEventInfo

```
private void testIRoutableObjectEventInfo(IEventInfo req) throws
APIException {
    IRoutableObjectEventInfo info = (IRoutableObjectEventInfo)req;
    //getWorkFlow()
    IWorkflow wf = info.getWorkFlow();
}
```

Approve for Workflow

The Information object for this Event is ISignOffEventInfo.

▫ **Purpose and function** – `ISignOffEventInfo` is the interface for Approve for Workflow and Reject for Workflow. It returns and overwrites information about status, approvers (users), approver groups, and checks the status of the signoff flag.

▫ **Inherited interfaces** – `IRoutableObjectCommentEventInfo,` `IRoutableObjectEventInfo, IObjectEventInfo, IEventInfo`

▫ **Inherited interfaces purpose and function** – `IRoutableObjectCommentEventInfo` is the interface for Comment for Workflow. It retrieves and overwrites data entered for Comments for Workflow, Approve for Workflow, and Reject for Workflow Events.

Reject for Workflow

See Approve for Workflow.

Escalation for Workflow

The Information object for this Event is `IEscalationEventInfo`.

▫ **Purpose and function** – `IEscalationEventInfo` retrieves the following information about the Escalation for Workflow Event:

- Sign-off user, escalated to users, escalation period, and status of the workflow

▫ **Inherited interfaces** – `IRoutableObjectEventInfo, IObjectEventInfo, IEventInfo`

▫ **Inherited interfaces purpose and function** – See Approve for Workflow.

Reminder for Workflow

The Information object for this Event is `IReminderEventInfo`.

▫ **Purpose and function** – `IReminderEventInfo` returns notifiers assigned to the Workflow reminder.

▫ **Inherited interfaces** – `IRoutableObjectEventInfo, IObjectEventInfo, IEventInfo`

Audit for Workflow

The Information object for this Event is `IAuditStatusEventInfo.`

▫ **Purpose and function** – `IAuditStatusEventInfo` retrieves the type of Workflow Audit Action that is performed.

▫ **Inherited interfaces** – `IAuditResultEventInfo, IRoutableObjectEventInfo,` `IObjectEventInfo, IEventInfo`

▫ **Inherited interfaces purpose and function** – `IAuditResultEventInfo` is the interface for Audit for Workflow and Promotion Failure for Workflow. It retrieves error messages for the audit or promotion failure.

Promotion Failure for Workflow

See Audit for Workflow.

Comment for Workflow

The Information object for this Event is `IRoutableObjectCommentEventInfo`. See Approve for Workflow.

Change Approvers or Observers for Workflow

The Information object for this Event is `IChangeAppObserverEventInfo`.

□ **Purpose and function** – `IChangeAppObserverEventInfo` retrieves the action type, status, and the applied to status of the Change Approvers or Observers for the Workflow Event plus the change action by the approver or observer on the Workflow state.

□ **Inherited interfaces** – See `IRoutingSlipEventInfo`.

Workflow Object Actions - Script PX

Change Status for Workflow

The Information object for this Event is `IChangeStatusScriptObj`.

□ **Purpose and function** – `IChangeStatusScriptObj` retrieves changes in the Workflow status of the object, the assigned notifiers, and checks whether the "auto-promote" flag is set or not set.

□ **Inherited interfaces** – `IRoutingSlipScriptObj` , `IRoutableScriptObj`, `IBaseObjectScriptObj, IBaseScriptObj`

□ **Inherited interfaces purpose and function**:

- `IRoutingSlipScriptObj` – **Inherited** interface for all Event Script objects that contain the Routing slip Object

- `IRoutablecriptObj` – **Inherited** interface for all Event Script objects related to workflow actions

The following examples show using `IChangeStatusScriptObj, IRoutingSlipScriptObj,` and `IRoutableObjectScriptObj`.

Example: Using IChangeStatusScriptObj

```
IChangeStatusScriptObj: Change Status for Workflow Event script object.
void testIChangeStatusScriptObj(IBaseScriptObj obj)
{
   // getFromStatus()
   String current_status = obj.getFromStatus();

   // getToStatus()
   String next_status = obj.getToStatus();

   // getNotifiers()
   String notifiers =obj.getNotifiers();

   // setNotifiers()
    obj.setNotifiers(["admin", "demo1","weiz", "demo5"]);
    // isAutoPromote()
   boolean  auto = obj.isAutoPromote();
```

```
 }
```

Example: Using IRoutingSlipScriptObj

```
 void testIRoutingSlipScriptObj(IBaseScriptObj obj)
 {
     // getCurrentUser()
     String user= obj.getCurrentUser();

     // getObservers()
     def observers = obj.getObservers();

     // getApprovers()
     def approvers = obj.getApprovers();

     // getComments()
     String  comments = obj.getComments();

     // isUrgent()
     boolean  flag = obj.isUrgent();

      // setApprovers()
      obj.setApprovers(["admin", "demo1"]);

      // setObservers()
      obj.setObservers(["demo6", "demo5"]);

      // setComments()
      obj.setComments(" new_comments");
      boolean new_urgent= true;

      // setUrgent()
      obj.setUrgent(new_urgent);
 }
```

Example: Using IRoutableScriptObj

```
 IRoutableScriptObj : get workflow
 void testIRoutableScriptObj(IBaseScriptObj obj)
 {


 // getWorkflow()
 String wf = obj.getWorkflow();
 }
```

Approve for Workflow

The Information object for this Event is `ISignOffScriptObj`.

▫ **Purpose and function** – `ISignOffScriptObj` is the interface for Approve for Workflow and Reject for Workflow. It returns information about status, approvers (users), approver groups, and checks the status of the signoff flag.

▫ **Inherited interfaces** – `IRoutableObjectCommentScriptObj, IRoutableScriptObj, IBaseObjectScriptObj, IBaseScriptObj`

□ **Inherited interfaces purpose and function** – `IRoutableObjectCommentScriptObj` – Interface for Comment for Workflow. It retrieves comments entered for the Routable object.

Reject for Workflow

See Approve for Workflow.

Escalation for Workflow

The Information object for this Event is `IEscalationScriptObj`.

□ **Purpose and function** – `IEscalationScriptObj` retrieves names of users to whom the Workflow is escalated to.

□ **Inherited interfaces** – `IRoutableScriptObj, IBaseObjectScriptObj, IBaseScriptObj`

□ **Inherited interfaces purpose and function** – See Approve for Workflow

Reminder for Workflow

The Information object for this Event is `IReminderScriptObj`.

□ **Purpose and function** – `IReminderScriptObj` returns notifiers assigned to the reminder period and Workflow reminder.

□ **Inherited interfaces** – `IRoutableScriptObj,  IBaseObjectScriptObj, IBaseScriptObj`

Audit for Workflow

The Information object for this Event is `IAuditStatusScriptObj`.

□ **Purpose and function** – `IAuditStatusScriptObj` retrieves the type of Workflow Audit Action that is performed.

□ **Inherited interfaces** – `IAuditResultScriptObj, IRoutableScriptObj, IObjectScriptObj, IBaseScriptObj`

□ **Inherited interfaces purpose and function** – `IAuditResultEventInfo` is the interface for Audit for Workflow and Promotion Failure for Workflow. It retrieves error or warning messages and Workflow status information for the audit or promotion failure.

Promotion Failure for Workflow

See Audit for Workflow.

Comment for Workflow

The Information object for this Event is `IRoutableObjectCommentScriptObj`. See Approve for Workflow.

Change Approvers or Observers for Workflow

The Information object for this Event is `IChangeAppObserverScriptObj`.

□   **Purpose and function** – `IChangeAppObserverScriptObj` retrieves the action type, status, and the applied to status of the Change Approvers or Observers for the Workflow Event and the change action by the approver or observer on the Workflow state.

□   **Inherited interfaces** – See `IRoutingSlipScriptObj`.

Working with Specific Object-Based Actions

These actions support incorporating and unincorprating the Item object in PLM's Production Collaboration solution and change status for Sourcing projects.

Specific Object-Based Actions - Java PX

Incorporate Item and Unincorporate Item

The Information object for this Event is `IObjectEventInfo`. This interface and applicable inherited interfaces are documented in General Object Actions - Java PX on page 85.

Change Status for Sourcing Project

The Information object for this Event is `ISourcingObjectChangeStatusEventInfo`.

□   **Purpose and function** – `ISourcingObjectChangeStatusEventInfo` retrieves the type of action that is performed on the Sourcing object.

□   **Inherited interfaces** – `IObjectEventInfo` and `IEventInfo`

Specific Object-Based Actions - Script PX

Incorporate Item and Unincorporate Item

The Script Event object for this Event is `IBaseObjectScriptObj`. This interface and applicable inherited interfaces are documented in General Object Actions - Script PX on page 89.

Change Status for Sourcing Project

The Information object for this Event is `ISourcingObjectChangeStatusScriptObj`.

□   **Purpose and function** – `ISourcingObjectChangeStatusScriptObj` retrieves the type of action that is performed on the Sourcing object.

□   **Inherited interfaces** – `IBaseObjectScriptObj` and `IBaseScriptObj`

Working with Files and Attachments Objects Actions

These are the file-related actions such as check out file, check in file, and purging version files.

Files and Attachments Objects Actions - Java PX

Get File, Check Out Files, Check In Files, Cancel Check Out Files

The Information object for these Events is `IFileEventInfo`.

□ **Purpose and function** – `IFileEventInfo` retrieves the Dirty files for the selected file attachments.

□ **Inherited interfaces** – `IObjectEventInfo` and `IEventInfo`

□ **Related interfaces** – `IEventDirtyFile` represents a single row in a file table, the interface for `IEventDirtyRowFileUpdate` or `IFileEventInfo`

The following example show using `IFileEventInfo`.

Example: Using IFileEventInfo

```
private void testIFileEventInfo(IEventInfo req) throws APIException {
    IFileEventInfo info = (IFileEventInfo)req;
    StringBuffer buffer = new StringBuffer();

    // getFiles()
    IEventDirtyFile[] files = info.getFiles();
    if(files!=null){
        int length = files.length;
        if (length!=0){
            for (int i=0;i<length;i++){
            String fileName = files[i].getFilename();
            String msg = i + ": " + fileName;
            System.out.println(msg);
            }
    }else {//rows == null
        throw new APIException (new Exception("getFiles() returns
        null"));
    }

    // Test IEventDirtyFile
    testIEventDirtyFile(files);
}
```

Purge File Version

The Information object for this Event is `IPurgeFileEventInfo`.

□ **Purpose and function** – `IPurgeFileEventInfo` retrieves the version for the purged file.

□ **Inherited interfaces** – `IObjectEventInfo` and `IEventInfo`

Files and Attachments Objects Actions - Script PX

Get File, Check Out Files, Check In Files, Cancel Check Out Files

The Event Script object for these Events is `IFileEventScriptObj`.

- ▫ **Purpose and function** – `IFileEventScriptObj` retrieves the Dirty files for the selected file attachments.

- ▫ **Inherited interfaces** – `IBaseObjectScriptObj` and `IBaseScriptObj`

Purge File Version

The Event Script object for this Event is `IPurgeFileScriptObj`.

- ▫ **Purpose and function** – `IPurgeFileScriptObj` retrieves the version for the purged file

- ▫ **Inherited interfaces** – `IBaseObjectScriptObj` and `IBaseScriptObj`

The following example show using `IFileEventScriptObj`.

Example: Using IFileEventScriptObj

```
// FileEventScriptObj: get file for file actions related events
void testIFileEventScriptObj(IBaseScriptObj obj,IEventDirtyRow row)
{
    // getFile()
    file =  row.getFile();
    testIEventDirtyFile(obj,file);
}
```

Example: Using IEventDirtyFile

```
IEventDirtyFile: get file information for Dirty file associated with
IEventDirtyRowFileUpdate
void testIEventDirtyFile(IBaseScriptObj obj,IEventDirtyfile file)
{

    // getFilename()
    String file_name = file.getFilename();

    // getSize()
    int file_size = file.getSize();

    // getType()
    file_type = file.getType();

    // getFileFolderNumber()
    file_folder_num = file.getFileFolderNumber();

    // getFileFolderVersionNumber()
    file_folder_ver = file.getFileFolderVersionNumber();
    //getCheckoutUser()
    user = file.getCheckoutUser();
```

```
// getCheckoutDate()
date = file.getCheckoutDate();

    obj.logMonitor("file name is:" + file_name);
    obj.logMonitor("file size is:" + file_size);
    obj.logMonitor("file type is:" + file_type);
    obj.logMonitor("file folder number is:" + file_folder_num);
    obj.logMonitor("file folder version number is:" +
    file_folder_ver);
    obj.logMonitor("checkout user is:" + user);
    obj.logMonitor("checkout date is:" + date);
```

Working with Product Governance and Compliance Actions

This action supports checking compliance of PG&C objects.

Product Governance and Compliance Actions - Java PX

Compliance Rollup On Object

The Information object for this Event is `IObjectEventInfo`. This interface and applicable inherited interfaces are documented in General Object Actions - Java PX on page 85.

Product Governance and Compliance Actions - Script PX

Compliance Rollup On Object

The Information object for this Event is `IBaseScriptObj`. This interface and applicable inherited interfaces are documented in General Object Actions - Script PX on page 89.

Working with Miscellaneous Object Actions

These are the file-related actions such as check out file, check in file, and purging version files.

Miscellaneous Object Actions - Java PX

Transfer Authority

The Information object for this Event is `ITransferAuthorityEventInfo`.

▫ **Purpose and function** – `ITransferAuthorityEventInfo` contains the data belonging to Transfer Authority action and retrieves and overwrites data set by the PLM client for the Transfer Authority action.

▫ **Inherited interfaces** – See `IExportEventInfo`.

Miscellaneous Object Actions - Script PX

Transfer Authority

The Information object for this Event is `ITransferAuthorityScriptObj`.

▫ **Purpose and function** – `ITransferAuthorityScriptObj` retrieves and overwrites data set by the PLM client for the Transfer Authority action.

▫ **Inherited interfaces** – `IBaseScriptObj`

Working with Event Integration Points in PLM Clients

Events can be invoked from Agile PLM clients' Extend Actions Menu, Extend Tools Menu, and Scheduled Event described below.

Event Integration Points - Java PX

Extend Actions Menu

The Information object for this Event is `IObjectEventInfo`. This interface and applicable inherited interfaces are documented in General Object Actions - Java PX on page 85.

Extend Tools Menu

The Information object for this Event is `IEventInfo`. This interface and applicable inherited interfaces are documented in General Object Actions - Java PX on page 85.

Scheduled Event

The Information object for this Event is `IEventInfo`. This interface and applicable inherited interfaces are documented in General Object Actions - Java PX on page 85.

Event Integration Points - Script PX

Extend Actions Menu

The Information object for this Event is `IBaseScriptObj`. This interface and applicable inherited interfaces are documented in General Object Actions - Script PX on page 89.

Extend Tools Menu

The Information object for this Event is `IBaseObjectScriptObj`. This interface and applicable inherited interfaces are documented in General Object Actions - Script PX on page 89.

Scheduled Event

The Information object for this Event is `IBaseScriptObj`. This interface and applicable inherited interfaces are documented in General Object Actions - Script PX on page 89.

Guidelines for Java PX and Script PX Handlers

These comments and recommendations are intended to ensure the proper development and implementation of your Java PXs and Script PXs. They include:

□   Information that you need from the Agile PLM Administrator to code the handler and information that you must convey to the Administrator to configure and implement the Event

□   Information to ensure proper handling of Events

□   Information to test your PXs

Working with Agile PLM Administrator

The Agile PLM Administrator will convey the necessary information to determine the Event type, execution mode and trigger type. Once you have developed the Java PX or Script PX handlers, you must inform the Administrator about the Event subscriber. This information includes Event type,execution mode, trigger type, order, and applicable error handling rule.

In addition to information about Event subscriber, the Administrator needs the following specific information to configure the Event Handler.

□   **Java PX Handlers –** Java PXs are deployed on the server, for procedures, see Packaging and Deploying a Custom Action on page 11. Once deployed, the Administrator locates it in Java Client by selecting **Admin > Settings > System Settings > Event Management > Event Handlers > New**. The Create Event Handler dialog box appears. In **Event Handler Type** field **select > Java PX > Event Action**. The Administrator needs to know the name that will appear in the **Event Action** field in order to configure the Handler.

Figure 17: Create event Handler dialog

- **Script PX Handlers –** The script PX code is a text file. You must send the script text file to the PLM Administrator. The Administrator will then paste it in the Script field of the Create Event Handler dialog and proceed to configure the Subscriber. This field is accessed from Java Client by selecting **Administrator > Event Management > Event Handlers > Create Event Handler > Script PX > Script**.

Figure 18: Create Script PX dialog

Testing Event Java PX and Event Script PX

If the Agile PLM Administrator uses your Handlers to configure the Event Subscriber, you should coordinate testing the PXs with the Administrator. On the other hand, if you do the configurations, then use the following information for this purpose.

Invoke the new Java PX or Script PX to ensure the action specified in the Handler (code) executes properly.

If the PX is configured to be invoked by a user action from the Tools menu, you can test it in Web Client or Java Client as follows:

- In Web Client tool bar select the ⚙ ▾ button **>** *Event_name*.

- In Java Client tool bar select the Process Extensions ⚡ button or **Tools > Process Extensions >** *Event_name.*

Triggering Guidelines for Java PX, Script PX, and Notification Handlers

Use the following guidelines when developing Handlers to ensure proper triggering of the special instances of these Event types.

General Object Actions

Create Object Event and SaveAs Event

▫ **Web Client and Java Client behavior** – This action will trigger one Create Object Event (or SaveAs Event) and its Context object will contain all Dirty attributes for Page 1, Page 2 and Page 3.

▫ **SDK behavior** – This action will trigger one Create object Event (or SaveAs Event). In addition, depending on table attributes that are updated (Page 1, Page 2 and Page 3), one to three Update Title Block Events are triggered. The context object will contain all Dirty attributes belonging to that table.

Update Title Block Event

Web Client, Java Client, and SDK behavior – Depending on table attributes that are updated (Page 1, Page 2 and Page 3), one to three Update Title Block Events are triggered, one for each table. The context object will contain all Dirty attributes belonging to that table.

Update Table Event

When you add, modify, or delete more than one row, this action has the following Event triggering behavior:

▫ One Event is triggered and the Context object will contain all applicable rows. The only exceptions are in Java Client:

- **Relationships Table–** One Event is triggered for each applicable row and the Context Object will contain the applicable row

- **Attachment Table –** For Update and Delete Actions, one Event is triggered for each applicable row and the Context Object will contain the applicable row

Workflow Actions

Promotion Failure for Workflow Event

This Event is triggered by the following actions:

▫ Failure of Change Status triggered through Relationship

▫ Autopromotion Failure – Autopromotion Failure is invoked by the following object actions when autopromotion conditions are not met after the completion of these actions. In addition, each triggered Event is tracked in the object History.

- Change Status
- Sign off the change
- Remove Approvers
- Update Cover Page, Page 2, and Page 3 attributes
- Edit Affected Item Table, Relationship, File Attachment Tab

  Note   Only editing will trigger "autopromote."

- Cancel checkout attachment
- Checkin attachment

Create Automatic Transfer Object Action (ATO)

ATO creation is enabled when ECO status is changed from Pending to Submitted. The sequence of Events that are triggered when the ATO is created is:

1. Pre and Post Event Subscribers are created for:
   - ECO Change status
   - ATO Create
   - ATO Change Status

2. An ECO is created

3. Workflow is assigned and status is changed to submitted

Files and Attachments Actions

Check In File Event

This action will trigger the following Events:

▫ Check In File Event on File Folder objects **–** This Event is triggered when the Check In file action is performed on File Folder objects.

▫ Check In File Event and Update Table Event on Business objects **–** These Events are triggered when the Check In file action is performed on Business objects.

> **Note**   Update Table Event on Business objects is triggered after Check In File Event is triggered. Also, The Event is only triggered if the folder version of the attachment is not set to **[LATEST]**. In Web Client one Event is triggered for all selected rows. In Java Client, one Event is triggered for each selected row.

Check Out File Action

This action will trigger the following Events:

▫ Check Out Files Event and Get File Event on File Folder objects **–** These Events are triggered when the Check Out file action is performed on File Folder objects

▫ Check Out Files Event and Get File Event on Business objects **–** These Events are triggered when the Check Out file action is performed on Business objects in Java Client,

   - If **Download files in one ZIP file** option is selected, one Get File Event is triggered and each row triggers a Checkout Event
   - If **Download files in one ZIP file** option is not selected, each row triggers one checkout Event and each file triggers a Get File event

> **Note**   In Web Client one Event is triggered for all selected rows. In Java Client, one Event is triggered for each selected row.

Cancel Check Out File Event

This action will trigger the following Events:

▫ Cancel Check Out Files Event on File Folder objects **–** This Event is triggered when the Cancel Check Out file action is performed on File Folder objects

▫ Cancel Check Out Files Event on Business objects **–** This Event is triggered when the Cancel Check Out file action is performed on Business objects

Note   In Web Client one Event is triggered for all selected rows. In Java Client, one Event is triggered for each selected row.

Get File Event

This Event is triggered by:

▫ Clicking the **Get** button on the Attachments table of Business objects or Files table of File Folder objects

▫ Clicking **Filename** on the Attachments table of the object

Note   If the file is viewable, Agile Viewer is launched and no event will be triggered.

▫ Check Out file action

Note   In Java Client, if users choose to download files individually instead of downloading the .ZIP file, one Event is triggered for each selected File.

Migrating Custom Process Extensions to Event Framework

This Appendix includes the following:

About this Appendix

This appendix provides information to:

1. Modify the Custom PX Java code created in Developing Process Extensions for use in Event framework.

2. Configure the modified code to function as a Java PX in the Event framework.

Understanding Custom PXs and Java PXs

The following paragraphs describe the difference between these PXs and lists the Custom PXs that you can migrate to Event framework and configure as Java PXs in Working with Events.

Custom PXs in PX Framework

Custom PXs defined and configured in Developing Process Extensions are a Java class deployed on the Agile Application Server, or a link to a URL. These PXs run in the PX framework. See the illustration in SDK Architecture (on page 3). The Java class Custom PXs includes the following types:

- Custom action PXs that implemented the server-side Java API `ICustomAction` interface in `com.agile.px` package

- Custom autonumber source PXs that implemented the server-side Java API `ICustomAutoNumber` interface in `com.agile.px` package

Process Extensions in Event Framework

PXs configured in Working with Events are one of the following types:

▫ Java process extensions (Java PX) that implemented the server-side API `IEventAction` interface in `com.agile.px` package

▫ Script process extensions (Script PX) that implemented the server-side API `invokeScript(IBaseScriptObj obj)` interface in `com.agile.agile.DSLObj` package

Note   To ensure proper operation of all Java process extensions, Oracle recommends recompiling existing Java-based PXs with the version of the JDK that is shipped with your application server.

Custom PXs You Can Migrate to Event Framework

The Event framework supports migrating only Custom Action PXs. These are PXs that are initiated from the Actions Menu, Tools Menu, and Workflow State (Status). See Using the Process Extension Library.

The corresponding Event types are:

Custom PX	Java PX
Actions Menu	Extend Actions Menu
Tools Menu	Extend Tools Menu
Workflow State (Status)	Change Status for Workflow

Migration Task List

Complete the following tasks to properly migrate a Custom PX to the Event framework and ensure its proper operation as a Java PX in this environment.

Task - 1: Modify the Custom PX Code

The following code samples show how to change an existing Custom PX code to a Java PX code in Event framework. The principal difference between a Java PX and a Custom PX is the interface the PX must implement. Java PXs implement `IEventAction` and Custom PXs implement `ICustomAction.`

Custom PX Code

This is an example of an existing Custom PX that appeared in <u>Defining a Custom Action</u> on page 13. To migrate Custom PXs, you must modify the code as shown in <u>Java PX Code</u> on page 117.

Example: A Custom PX

```
public class HelloWorld implements ICustomAction
{
    public ActionResult doAction(IAgileSession session, INode
    actionNode, IDataObject affectedObject)
    {

                ...

            return new ActionResult(ActionResult.STRING, "Hello World");
    }
}
```

Java PX Code

The following example is the modified Custom PX to run in the Event framework. Code modifications that enabled this migration appear in the **bold** font.

Example: The Custom PX code after modification

```
public class HelloWorld implements IEventAction
{
    public EventActionResult doAction(IAgileSession session, INode
    actionNode, IEventInfo request)
    {
        IObjectEventInfo objectEventInfo = (IObjectEventInfo) request;
        IDataObject affectedObject = objectEventInfo.getDataObject();


            ...

        ActionResult actionResult = new ActionResult(ActionResult.STRING,
        "Hello World");
        return new EventActionResult(request, actionResult);
    }
}
```
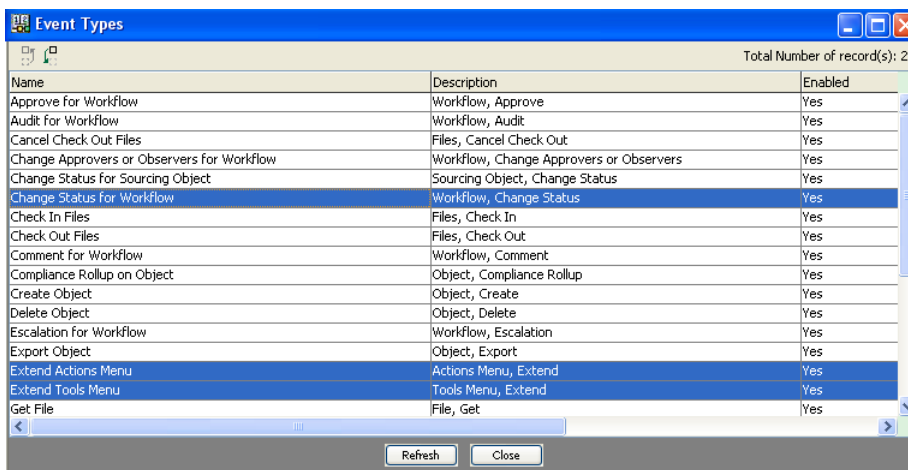
Note   Java PXs get their IDataObject values from IEventInfo.

Task - 2: Package and Deploy the Modified Code

Create JAR files to package and deploy the modified Java code for use in the Event framework. For procedures, see Packaging and Deploying a Custom Action on page 11. This package is the "action" that you will use to complete Task - 3: Configure Event in Event Framework on page 118.

Task - 3: Configure Event in Event Framework

The Event Types dialog lists the supported Event types in Event framework. The supported types for Custom PXs you are migrating are Change Status for Workflow, Extend Actions Menu, and Extend Tools Menu. Procedures to create and configure these Events appear next. You can find additional information in Working with Events and in the *Agile PLM Administrator Guide*.

Create Event

To create the Event:

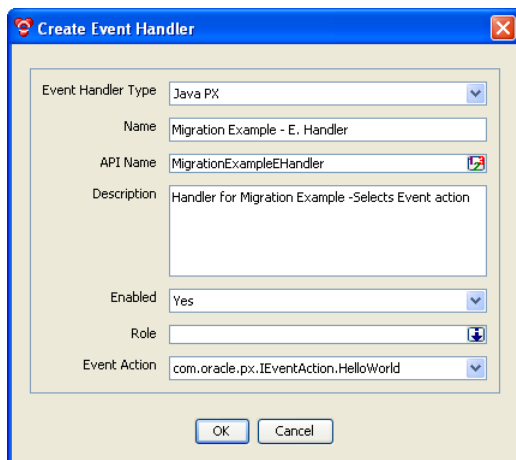1. Log in to Java Client with Administrator privileges.

2. Select **Admin > System Settings > Event Management > Events > New button** ▤. The Create Event dialog appears.

3. In **Event Type**, click the drop-down arrow and select your Event from the list.

Figure 19: Create an Extend Tools Menu Event

Figure 20: Change Status for Workflow   **Figure 21: Extend Actions Menu**
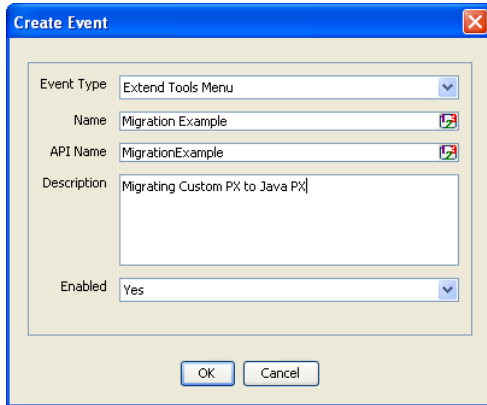
Note   Fields in the Create Event dialog are not the same for all Event Types. For example, in Update Title Block, you are assigning the object's class, but in Approve for Workflow, you select a status for the Workflow. For information on assigning object classes and Workflow status, see Assigning Process Extensions to Classes Assigning Process Extensions to Classes and Assigning Process Extensions to Workflow Statuses.

4. Select your Event Type and provide the required information, for example, as shown below. For more information on completing this dialog, refer to *Agile PLM Administrator Guide*.

Figure 22: Create an Extend Tools Menu Event
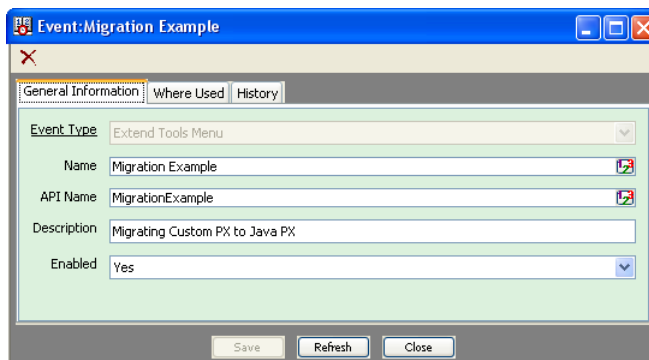
5. Click **OK**. The Event:*Even_Name* page appears.

Figure 23: Event General Information page

You can modify the Event from this dialog. When you make a change, the **Save** button is enabled. Also, this Event is listed in the Events view. To view, select **Event Management > Events**. The next task is to create the handler for this Event.

Create Event Handler

The Event Handler enables executing the compiled Java code. The following procedure guides you through this step.

To create the Event Handler:

1. In Java Client with Administrator privileges, select **Admin > Systems Settings > Event Management > Event Handlers > New button** 📇. The Create Event Handler dialog opens.

Figure 24: Create event Handler dialog

2. In Create Event Handler dialog, do as follows:

    •   In Event Handler drop-down list, select Java PX.

    •   In Event Action field, select the class you created in .

    •   In Role field, if left blank, Event Handler will use the roles of the current user by default. However, you can configure a custom action to have override privileges. Refer to *Agile PLM Administrator Guide* for information and procedures.

    •   Complete the remaining fields and click **OK**.
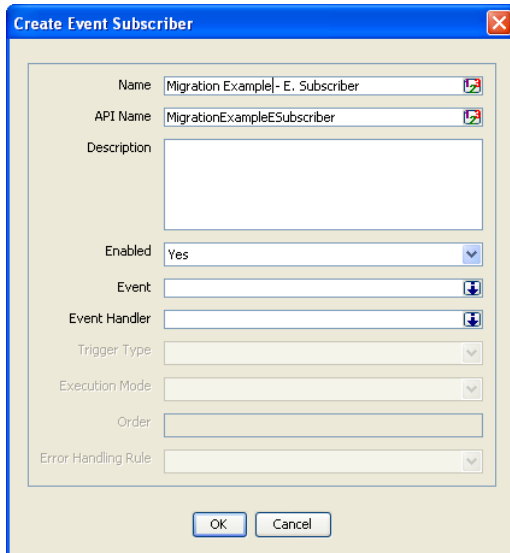
Create Event Subscriber

This is a process that binds a Java PX to a specific event. This is done using the Create Event Subscriber dialog to:

▫   Bind the Event with the Event Handler

▫   Set the triggering order (sequence)

▫   Set the execution mode

To create Event Subscriber:

1. Log in to Java Client with Administrator privileges and select **Admin > Systems Settings > Event Management > Event Subscribers > New button** 🖼. The Create Event Subscriber dialog opens.

Figure 25: Create Event Subscriber dialog

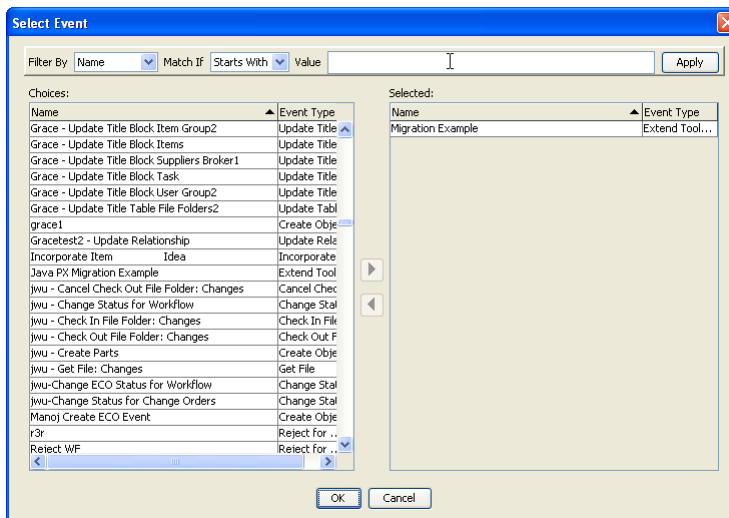2. In the Create Event Subscriber dialog, do as follows:

    *   Select Event for this Event Subscriber: Click the drop-down list 🖼 in the Event field. The Select Event dialog opens.

    *   In Select Event dialog, locate and select the applicable Event, move it to the Selected column, and then click **OK**.

Figure 26: Select Event for Event Subscriber

    *   Select Event Handler for this Event Subscriber: Click the drop-down list 🖼 in the Event Handler field. The Select Event Handler dialog opens. In Select Event Handler dialog locate and select the applicable Event Handler, move it to the Selected column, and then

click **OK**.

Figure 27: Select Event Handler for Subscriber
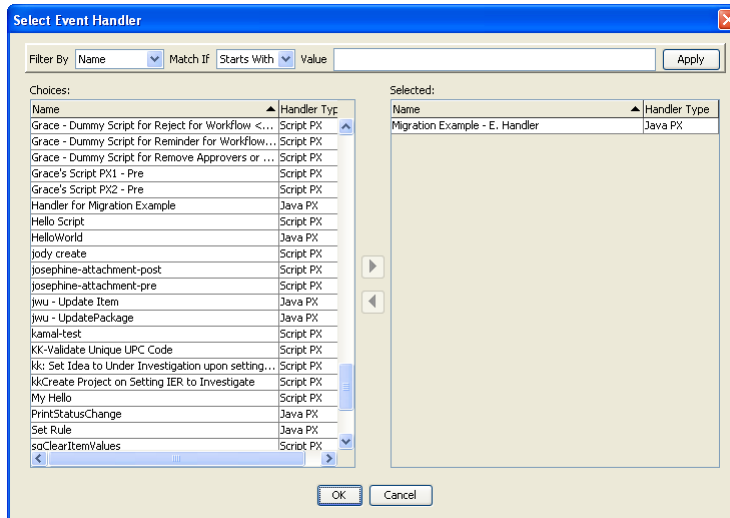
Note After completing this step, some of the four fields in the Create Event Subscriber dialog that are grayed out can be configured now. For example, Trigger Type and Execution Mode.

Configure Trigger Type, Execution Mode, Order, and Error Handling Rule

Event trigger types and Event execution mode plus the order in which the Event is invoked and error handling rule options that you must set are defined below.

Trigger Type Field

This field has two options as follows:

▫ **Pre** – This trigger type signals a point prior to the occurrence of an action. The **Pre** trigger is commonly used for events that require data or other preparations for the upcoming action. Event subscribers configured with this trigger type are executed in the Synchronous Execution Mode only.

▫ **Post** – This trigger type signals a point immediately after the occurrence of an action. This trigger is used for events that perform auditing tasks based on the prior action. You can execute Event subscribers configured with this trigger type in either Synchronous or Asynchronous Execution Modes.

> **Note** For migrated Custom PXs, always select **Post**. Custom PXs always run after the action has occurred.

Execution Mode Field

This field has the Synchronous and Asynchronous options. In general, the term synchronous means occurring simultaneously and asynchronous means not occurring simultaneously. A synchronous operation blocks a process until the operation completes while an asynchronous operation is non-blocking and only initiates the operation.

In Agile PLM, the difference between the two options is:

▫ **Synchronous** – In this mode, the Event Handler will be executed in the same thread as the Agile PLM thread that triggers the event (for example, a change in a Workflow status). The original Agile PLM action will resume after the handler action finishes (Block).

> **Note** For migrated PXs always select **Synchronous**.

▫ **Asynchronous** – In this mode, the Event Handler has its own thread and it cannot be stopped once it is started. This transaction is either committed or rolled back based on its own status. The Agile PLM thread that triggers the event will continue to run independently regardless of the Handler action has finished or not (Non-block).

Order Field

Order field is a positive integer that determines the "Order" in which the Event handler is invoked. This is useful when there are multiple Event Subscribers for the same Event type on the same Agile object.

> **Note** If you have both Custom PXs and Java PXs configured for a Workflow Change Status action, Java PXs always execute before Custom PXs.

Error Handling Rule

This field is set by the user for the Synchronous Execution Mode only. Options are Continue (the default value) and Stop. The selected option determines the behavior of Agile PLM when an error is encountered while processing the Event Subscriber. For more information on error handling rules, refer to *Agile PLM Administrator Guide.*

▫ **Continue** – This option ignores the error and the Event continues to process the remaining subscriptions.

▫ **Stop** – This option will stop further Event processing and returns to the originator that raised the Event.

Note   For migrated PXs, select **Continue**.

Example: Configure Event Subscriber for Migrated PX:

1. In Java Client select **Admin > Event Management > Event Subscribers > New button** 📧. The Event Subscriber dialog appears.

2. Set the options in Trigger Type, Execution Mode, and Error Handling Rule fields as shown below.

    These are the recommended options for migrated PXs.

Figure 28: Event Subscriber dialog

Task - 4: Test the Migrated PX in Event Framework

Invoke the new Java PX to ensure the action specified in the Handler (code) occurs. Depending on the Event type, the Java PX can be invoked by a user from the Extend Actions or Extend Tools menu, or by a Change Status in Workflow. Make sure the migrated PX's behavior in Event framework is the same as its behavior in PX framework.

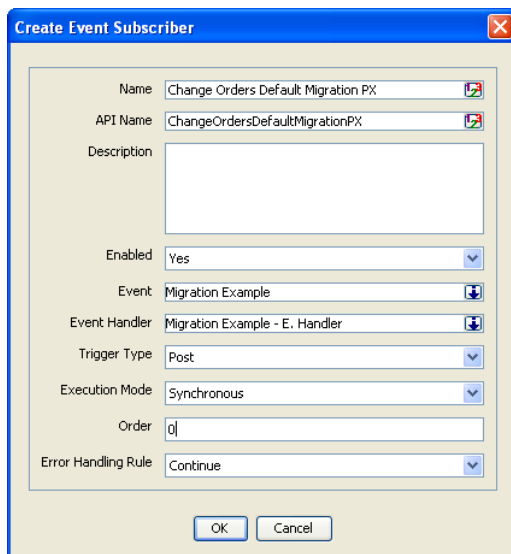If the PX is configured to be invoked by a user action from the Tools menu, you can test it in Web Client or Java Client as follows:

▫ In Web Client tool bar select the ⚙ ▾ button > *Event_name*.

▫ In Java Client tool bar select the Process Extensions ⚡ button or **Tools > Process Extensions > *Event_name*.**

Task - 5: Remove Custom PX from Process Extension Library

It is a good practice to delete the Custom PX that you have migrated from the Agile Process Extensions Library. This will prevent any duplicate execution of the Custom PX and Java PX.

To remove the Custom PX from PX library:

1. Delete all references to the Custom PX.

2. Open Java Client's **Process Extensions Library** and select and delete the PX.

Task - 6: Inform PLM Administrator

As shown in the Task - 3: Configure Java in Event Framework Task - 3: Configure Event in Event Framework on page 118, Event configuration is a UI-based Admin function performed in the Java Client by an Admin user. Depending on your role as the SDK developer, be sure to inform the PLM Admin as follows:

▫ If Event Subscriber creation and configuration is a PLM Admin function, be sure to inform the cognizant administrator after deploying the modified Custom PX code in Task - 2: Package and Deploy the Modified Code on page 118. This is to inform the PLM Admin of the new Event Handler and its specifics to use and complete the remaining tasks.

▫ If on the other hand you perform the UI-based configurations in Java Client, inform your PLM Admin of the new Java PX, its intended purpose and function and the necessary information to use the new Java PX in PLM clients.

Groovy Implementation in Event Framework

This Appendix includes the following:

About this Appendix

This appendix provides a description of the Groovy scripting language and sources of information about this tool. Other topics addressed include how to start a script, access the SDK using scripts, and sample use cases.

What Is Groovy?

Groovy is an object-oriented programming language that can be used as a scripting language for the Java Platform.

Sources of Information

World Wide Web provides links to many sites that offer information about Groovy. Publishers and vendors of the print media also offer information on this tool. A few are listed below.

▫ From World Wide Web:

- **Groovy Home** – Provides links to documentation, downloads, tutorial, user guide, Eclipse plugin examples, advanced usage guide, and other sites maintained by Groovy Home (http://groovy.codehaus.org/)

▫ From publishers and vendors:

- **Publisher: Manning Publications** – Groovy in Action by Dierk Koenig, Andrew Glover, Paul King, and Guillaume Laforge

- **Publisher: Morgan Kaufmann** – Groovy Programming: An Introduction for Java Developers by Kenneth Barclay and John Savage

Script PX or Java PX?

Scripts are suitable for rapid development and deployment of applications with simple business logic. They empower Agile PLM Admins and power users to develop extensions unique to their requirements and make rapid modifications when necessary. Scripts are not suitable for developing complex applications with performance critical data structures.

Use scripts to:

- Automate functions with simple business logic such as data validation, notification, or defaulting field values

- Implement unique customization for existing applications

- Build extensions to existing systems

- Rapid prototyping

- Write test use cases

Event Framework Implementation

Event framework implementation requires running the scripting engine. Key inplementation considerations are summarized below.

Key implementation considerations

- The scripting engine runs inside the Java 2 Platform Enterprise Edition (J2EE) on the Agile PLM server and is based on the Groovy language.

- Groovy is fully embedded in Event framework.

- Groovy is the only supported scripting language.

- Script codes are currently stored in CLOB fields in the Agile PLM database.

- Event Script objects (Event Script PX handlers) that you develop are text files that are deployed from the Event Management Node by selecting **Event Management > Event Handlers** in Java Client.

- Scripts can call the Script API and Agile SDK.

- The *Agile PLM Administrator Guide* provides both background information and sample procedures to understand and manage Events.

Starting a Script

1. Use `void invokeScript(IBaseScriptObj obj)` to start your script. `InvokeScript` is script's starting point of the execution and `IBaseScriptObj` is the base interface for all Event Script Objects.

2. The run time type of the `obj` is dynamically resolved based on the type of Event that invoked this script. For example, if the script is invoked on a Create Event, then `ICreateScriptObj` is dynamically resolved as the type of `obj` at run time. You can invoke any method defined on `ICreateScriptObj` and its super-interfaces on the instance of this `obj`.

3. Use `IAgileSession getAgileSDKSession()` to access the SDK session and invoke SDK functions.

4. Use `AgileDSLException` to return "exception" information from scripts.

Accessing SDK with Scripts

You can access an SDK session and Java PX Event object when writing SDK programs in a script.

```
/**
   * Returns agile SDK session.
   * @return agile SDK session
   * @throws AgileDSLException
   *        if the method fails
   * @since \@Agile93@
*/
public IAgileSession getAgileSDKSession() throws AgileDSLException;


/**
   * Returns PX eventInfo.
   * @return PX eventInfo
   * @throws AgileDSLException
   *        if the method fails
   * @since \@Agile93@
*/
public IEventInfo getPXEventInfo() throws AgileDSLException;
```

Use Cases

You can find Script PX Handler examples for most Event types in <u>Client-Side Components</u> on page 2. These handlers utilize the Pre/Post triggers and Synchronous/Asynchronous executions and cause different actions when they are invoked.

Variant Management Configuration Graph Schema

This Appendix includes the following:

About this Appendix

The schema in this appendix describes the structure of a Configuration Graph XML document.

The XML Schema

```xml
<?xml version="1.0" encoding="windows-1252"?>
<xsd:schema
targetNamespace="http://xmlns.oracle.com/Agile/ABO/Configurator"
xmlns="http://xmlns.oracle.com/Agile/ABO/Configurator"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" attributeFormDefault="unqualified">
    <xsd:element name="ConfiguratorInitReq"
    type="ConfiguratorInitReqType"/>
    <xsd:complexType name="ConfiguratorInitReqType">
        <xsd:annotation>
      <xsd:documentation xml:lang="en">
          <b>The request ABO for getURL service call in Agile getURL
          Requester ABCS.</b>
          <b>ModelID: The model ID for which the init message has to be
          created.</b>
          <b>Organisation: The organisation that is to be used for this
          BOM.</b>
          <b>ReturnURL: The return URL for the termination message if
          any from client  side.</b>
            </xsd:documentation>
            </xsd:annotation>
            <xsd:sequence>
                <xsd:element name="ModelD" type="xsd:string"/>
                <xsd:element name="Organisation" type="xsd:string"
            minOccurs="0"/>
                <xsd:element name="ReturnURL" type="xsd:string"
            minOccurs="0"/>
                <xsd:element name="ConfigHeaderId" type="xsd:string"
            minOccurs="0"/>
            </xsd:sequence>
    </xsd:complexType>
```

```xml
<xsd:complexType name="ConfiguratorInitResponseType">
      <xsd:annotation>
         <xsd:documentation xml:lang="en">
         <b>The Response ABO for getURL service call in Agile
         getURL Requester ABCS.</b>
         <b>URL: url of the target server.</b>
         <b>initializePL: Init message to be posted on the URL
         as a long String.</b>
         <b>any: If the init message is XML.</b>
      </xsd:documentation>
       </xsd:annotation>
      <xsd:sequence>
         <xsd:element name="URL" type="xsd:string"/>
         <xsd:element name="initializePL" minOccurs="0">
       <xsd:complexType>
         <xsd:simpleContent>
           <xsd:extension base="xsd:string">
             <xsd:attribute name="paramName" type="xsd:string"/>
               </xsd:extension>
                </xsd:simpleContent>
              </xsd:complexType>
             </xsd:element>
             <xsd:any minOccurs="0"/>
          </xsd:sequence>
         </xsd:complexType>
             <xsd:complexType name="ConfiguratorBOMType">
               <xsd:annotation>
          <xsd:documentation xml:lang="en">
          <b>The configuratorBOM response type.</b>
          <b>AppHeader:The App header for agile specific
          parameters.</b>
          <b>ConfigHeader: Configurator Header</b>
          <b>BOM: BOM representing the selected option BOM.</b>
        </xsd:documentation>
       </xsd:annotation>
       <xsd:sequence>
          <xsd:element name="AppHeader" type="AppHeaderType"
          minOccurs="0"/>
          <xsd:element name="ConfigHeader"
          type="ConfiguratorHeaderType" minOccurs="0"/>
          <xsd:element name="BOM" type="BomType" minOccurs="0"/>
         </xsd:sequence>
      </xsd:complexType>
      <xsd:complexType name="AppHeaderType">
         <xsd:annotation>
            <xsd:documentation xml:lang="en">
             <b>The header for adding agile specific data.</b>
             </xsd:documentation>
       </xsd:annotation>
```

```
        <xsd:sequence>
             <xsd:element name="UserID" type="xsd:string"/>
        </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="ConfiguratorHeaderType">
        <xsd:annotation>
             <xsd:documentation xml:lang="en">
             <b>The header info from Configurator EBO.</b>
             <b>ConfigHeaderId: Header ID</b>
             <b>ConfigRevision: Confi Revision</b>
             <b>ValidConfiguration: Represent ValidConfiguration</b>
             <b>CompleteConfiguration: Complete configuration</b>
             <b>ExitType: Exit type</b>
             <b>PricesCalculatedFlag: Flag to see if the price
             calculated.</b>
             <b>BomQuantity: Quantity of the BOM itself.</b>
           </xsd:documentation>
        </xsd:annotation>
        <xsd:sequence>
             <xsd:element name="ConfigHeaderId" type="xsd:string"/>
             <xsd:element name="ConfigRevision" type="xsd:string"/>
             <xsd:element name="ValidConfiguration"
             type="xsd:string"/>
             <xsd:element name="CompleteConfiguration"
             type="xsd:string"/>
             <xsd:element name="ExitType" type="xsd:string"/>
             <xsd:element name="PricesCalculatedFlag"
             type="xsd:string"/>
             <xsd:element name="BomQuantity" type="xsd:int"/>
        </xsd:sequence>
     </xsd:complexType>
     <xsd:complexType name="BomType">
       <xsd:annotation>
           <xsd:documentation xml:lang="en">
           <b>The BOM consisting of different options.</b>
           <b>ModelID: Model ID</b>
           <b>OrganizationCode: Organisation code for the BOM</b>
           <b>ConfigParameters: BomParameters for the BOM</b>
           <b>Option: The child Options</b>
       </xsd:documentation>
     </xsd:annotation>
     <xsd:sequence>
           <xsd:element name="ModelID" type="xsd:string"/>
           <xsd:element name="OrganizationCode"
           type="xsd:string"/>
           <xsd:element name="ConfigParameters"
           type="BomParameters"/>
           <xsd:element name="Option" type="OptionType"
           minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
     </xsd:complexType>
```

```xml
            <xsd:complexType name="OptionType">
              <xsd:annotation>
               <xsd:documentation xml:lang="en">
                  <b>The option line items.</b>
                  <b>ItemID: The ItemID</b>
                  <b>ConfigParameters: The Bom parameteres for this
                  Option</b>
                  <b>Option: The child Options</b>
               </xsd:documentation>
              </xsd:annotation>
              <xsd:sequence>
                  <xsd:element name="ItemID" type="xsd:string"/>
                  <xsd:element name="PositionID" type="xsd:string"
                  minOccurs="0"/>
                  <xsd:element name="ConfigParameters"
                  type="BomParameters"/>
                  <xsd:element name="Option" type="OptionType"
                  minOccurs="0" maxOccurs="unbounded"/>
              </xsd:sequence>
            </xsd:complexType>
            <xsd:complexType name="BomParameters">
              <xsd:annotation>
               <xsd:documentation xml:lang="en">
                  <b>The type representing the Bom parameters.</b>
                  <b>BomTypeCode: Represents BOM type code</b>
                  <b>Quantity: Quantity used</b>
                  <b>Uom: Unit of measurement</b>

               </xsd:documentation>
              </xsd:annotation>
              <xsd:sequence>
                  <xsd:element name="BomTypeCode" type="xsd:string"/>
                  <xsd:element name="Quantity" type="xsd:float"/>
                  <xsd:element name="Uom" type="xsd:string"/>
              </xsd:sequence>
            </xsd:complexType>
            <xsd:simpleType name="ABCSStatus">
                <xsd:annotation>
                 <xsd:documentation xml:lang="en">
                  <b>Status texts for responses</b>
                 </xsd:documentation>
            </xsd:annotation>
            <xsd:restriction base="xsd:string">
                  <xsd:enumeration value="SUCCESS"/>
                  <xsd:enumeration value="FAILURE"/>
                  <xsd:enumeration value="WARNING"/>
                  <xsd:enumeration value="ERROR"/>
                  <xsd:enumeration value="FATAL"/>
            </xsd:restriction>
            </xsd:simpleType>
  </xsd:schema>
```